

MEMORANDUM

DATE: December 17, 2008

TO: Chief Academic Officers
Montana University System

FROM: Sylvia Moore
Deputy Commissioner of Academic & Student Affairs

RE: Level II Submission Items

The campuses of the Montana University System have proposed new academic programs or changes under the Level II approval process authorized by the Montana Board of Regents. The Level II proposals are being sent to you for your review and approval. If you have concerns about a particular proposal, you should share those concerns with your colleagues at that institution and try to come to some understanding. If you cannot resolve your concerns, you need to notify the Office of the Commissioner of Higher Education by December 30, 2008. That notification should be directed to Sarah Elkins, administrative assistant for Academic & Student Affairs. If Sarah does not hear from you, in writing, by December 30, OCHE will assume that the proposals have your approval.

The Level II proposals are as follows:

Montana State University-Bozeman:

- Montana State University-Bozeman asked for permission to offer a Master of Science in Health Sciences [ITEM142-2001-0109 MSU MS HS](#) [ITEM142-2001-0109 sm1 MSU MS HS](#) [ITEM142-2001-0109 sm2](#)
- Montana State University-Bozeman asked for permission to offer a Master of Arts and PhD in American Studies [ITEM142-2002-0109](#) [ITEM142-2002-0109 sm1](#) [ITEM142-2002-0109 sm2](#)

University of Montana-Missoula:

- The University of Montana-Missoula asked for permission to establish a 2+2 engineering program in collaboration with Montana Tech of the University of Montana [ITEM142-1001-0109 UM Engineering](#) [ITEM142-1001-0109 sm1 UM Engineering](#) [ITEM142-1001-0109 sm2](#) [ITEM142-1001-0109 sm3](#)

- The University of Montana-Missoula asked for permission to establish a Biochemistry program and to offer a BS in Biochemistry within this consolidated program [ITEM142-1002-R0109 UM Biochemistry](#) [ITEM142-1002-R0109_sm1 UM Biochemistry](#) [ITEM142-1002-R0109_sm2 UM Biochemistry](#)
- The University of Montana-Missoula asked for permission to create a new minor in Climate Change Studies [ITEM142-1004-R0109 UM Climate Change Minor](#) [ITEM142-1004-R0109_sm1 UM Climate Change Minor](#) [ITEM142-1004-R0109_sm2 UM Climate Change Minor](#)
- The University of Montana-Missoula asked for permission to establish an M.S. in Special Education [ITEM142-1005-R0109 UM MS](#) [ITEM142-1005-R0109_sm1 UM Climate Change Minor](#) [ITEM142-1005-R0109_sm2 UM Climate Change Minor](#)
- The University of Montana-Missoula College of Technology requested permanent approval of the experimentally offered Energy Technology Associate of Applied Science degree program [ITEM142-1003-R0109 UMCOT Energy Tech](#) [ITEM142-1003-R0109_sm1 UMCOT Energy Tech](#) [ITEM142-1003-R0109 UMCOT Energy Tech](#)

Flathead Valley Community College

- Flathead Valley Community College requested permission to establish an A.A.S in Graphic Design [ITEM142-301-R0109](#) [ITEM142-301-R0109_sm1](#) [ITEM142-301-R0109_sm2](#)

January 7, 2009

ITEM 142-2001-R0109 **Master of Science in Health Sciences, MSU-Bozeman**

THAT: The Board of Regents of Higher Education authorizes Montana State University Bozeman to establish a Master of Science Degree in Health Sciences

EXPLANATION: The proposed Master of Science Degree Program in Health Sciences will be managed through the Division of Health Sciences, Montana State University-Bozeman. The intent of this program is to provide students with a broad-based graduate education that can be applied to any of several career paths in the health care field. This program would support and formalize the educational endeavors of MSU graduates, Post Baccalaureate Pre-Medical Certificate students, and non-certificate students who attend MSU to better prepare for entrance into healthcare-related professional schools. In addition, a Master's degree in Health Sciences, with an emphasis on health-related topics, will also be useful for students seeking direct employment in the health care system and in the state of Montana.

The proposed program will be a Plan B Master of Science degree requiring a minimum of 30 credits from a list of recommended courses and culminating in a scholarly project, to be completed within a calendar year. Briefly, the proposed Master of Science program will effectively be a 1+1 design, where students qualifying for the Post Baccalaureate Pre-Medical Certificate program will enter under a 2-year plan. These students will take the professional school prerequisite courses during the first year, as they currently do, and earn the Certificate. These same students can then declare an emphasis and continue into the second year, pursuing the flexible schedule and broad-reaching course availability to complete the 30 credits necessary for the Master in Science degree. Additionally, students who have a solid science background, and thus do not qualify for the Certificate program, can be eligible to enter directly into the one year Master of Science Program. The prerequisites for the proposed Master of Science degree will be such that we ensure students have a substantial foundation in the basic sciences and in more applied health-related areas.

M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.:	142-2001-R0109	Date of Meeting:	January 7, 2009
Institution:	Montana State University-Bozeman		
Program Title:	Master of Science Degree in Health Sciences		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

We are proposing a Plan B Master of Science Degree in Health Sciences that will be managed through the Division of Health Sciences, Montana State University-Bozeman. The intent of this program is to provide students with a broad-based graduate education that can be applied to any of several career paths in the health care field. This program would support and formalize the educational endeavors of MSU graduates, Post Baccalaureate Pre-Medical Certificate students, and non-certificate students who attend MSU to better prepare for entrance into healthcare-related professional schools. In addition, a Master's degree in Health Sciences, with an emphasis on health-related topics, will also be useful for students seeking direct employment in the health care system and the state of Montana.

The prerequisites for, and curriculum offered by, the proposed Master of Science degree will be such that we ensure students have a substantial foundation in the basic sciences and in more applied health-related areas.

**MASTER OF SCIENCE DEGREE IN HEALTH SCIENCES
MONTANA STATE UNIVERSITY - BOZEMAN**

1. OVERVIEW

The proposed Master of Science Degree Program in Health Sciences will be managed through the Division of Health Sciences, Montana State University-Bozeman. The intent of this program is to provide students with a broad-based graduate education that can be applied to any of several career paths in the health care field. This program would support and formalize the educational endeavors of MSU graduates, Post Baccalaureate Pre-Medical Certificate students, and non-certificate students who attend MSU to better prepare for entrance into healthcare-related professional schools. In addition, a Master's degree in Health Sciences, with an emphasis on health-related topics, will also be useful for students seeking direct employment in the health care system and in the state of Montana.

The proposed program will be a Plan B Master of Science degree requiring a minimum of 30 credits from a list of recommended courses and culminating in a scholarly project, to be completed within a calendar year. Briefly, the proposed Master of Science program will effectively be a 1+1 design, where students qualifying for the Post Baccalaureate Pre-Medical Certificate program will enter under a 2-year plan. These students will take the professional school prerequisite courses during the first year, as they currently do, and earn the Certificate. These same students can then declare an emphasis and continue into the second year, pursuing the flexible schedule and broad-reaching course availability to complete the 30 credits necessary for the Master in Science degree. Additionally, students who have a solid science background, and thus do not qualify for the Certificate program, can be eligible to enter directly into the one year Master of Science Program. The prerequisites for the proposed Master of Science degree will be such that we ensure students have a substantial foundation in the basic sciences and in more applied health-related areas.

2. NEED***a. To what specific need is the institution responding in developing the proposed program?***

The Montana Healthcare Workforce Advisory Committee, at the behest of the Montana Office of the Commissioner of Higher Education, prepared a comprehensive analysis of the healthcare workforce needs in the state of Montana that was released in Spring 2007¹. The committee documented that 1) healthcare is the largest private sector employer in Montana, 2) much of the state is classified as medically underserved with substantial state and regional professions shortages, and 3) that the need is only going to increase with the aging population and natural attrition of providers. Based on this growing need, the committee made recommendations to implement programs that increase the pipeline of health professionals and to invest in flexible education programs to reach nontraditional students. The proposed Master of Science in Health Sciences program, although a

fundamental educational experience, will be strategically designed to facilitate student entry into the healthcare workforce and health professional schools. This program will facilitate a pipeline of health professionals by preparing students for successful entrance into professional schools, as well as providing an educational foundation on which to compete in the healthcare workforce. In addition, the flexibility, accelerated pace, faculty and administrative support, and design of the program are meant to foster career-changing opportunities for nontraditional students.

b. How will students and any other affected constituencies be served by the proposed program?

In addition to the documented need for health care professionals in the state of Montana, we are also considering demand for the Master's degree from the student perspective. There is a population of students who are re-entering the educational system to better prepare themselves for health professional schools. These students fall under two general categories: 1) students who have a baccalaureate degree in a non-science major and need to acquire substantial science course prerequisites, and 2) students who have a baccalaureate degree in a science/engineering major but who need humanities/social science prerequisite coursework, academic enhancement, or academic refreshment. This Master's degree program is aimed at providing the necessary academic experience for both categories of students.

c. What is the anticipated demand for the program? How was this determined?

The success of the Post Baccalaureate Pre-medical Certificate program has allowed us to document interest in this area of education. We have matriculated 3 classes of Certificate students (ranging from 9 to 17 students/class) and our applicant pool has doubled (from 33 to 64) over those three years. In addition, the office of Health Professions Advising supports approximately 10 non-Certificate Post Bacc students each year. By definition, the Certificate (and non-Certificate) students complete their educational program prior to taking the entrance exam for professional school. These students then have a 'glide' year prior to matriculation in said professional school. Many Certificate students have conveyed an interest in participating in the Master's program in order to spend the 'glide' year in an educationally productive manner. Nearly all students queried would appreciate participation in a degree-seeking program and the opportunity to complete a Master's degree in the process.

Here are examples of student interest.

'PLEASE get this going by next fall so I can get 'er done before medical school. I will volunteer my time to lick envelopes if it helps. This is fantastic that you are considering this kind of program. I was already happy with having so much support for post-bacc pre-med endeavors here at MSU. This degree program would be a dream come true for me.' current non-Certificate student.

'Yes, I think it would be very beneficial to go through this program and come away with something more tangible than a certificate, such as a Master's degree. That would be ideal' current Certificate student.

‘I am extremely interested and wish this would have been available a few years ago as I did not qualify for the certificate program and would really like to be working on an advanced degree! former non-Certificate student.

‘This is FABULOUS and I am really excited about the program. It makes A LOT of sense. I think it would be great if it would incorporate some public health issues the second year- maybe incorporating what's at Billings (their masters of health administration)? Also, and ability to travel for international medical research or something would be REALLY cool!’ current non-Certificate student.

The Post Baccalaureate Pre-medical Certificate program has also provided us with an opportunity to evaluate student expectations of a program. Many of the Certificate applicants are qualified and accepted, but ultimately select other programs that meet their needs more fully. The availability of a Master’s degree option will make MSU more competitive in recruiting highly qualified students to its campus. The Master’s degree program would draw applicants from the region who wish to remain here for their coursework and ultimately return here for their careers, but will also attract out-of-state applicants (the Certificate program currently averages 50% out-of-state students).

The Master’s degree in Health Sciences is an underrepresented program in the region². The model of the proposed Master of Science in Health Sciences is similar in design, but not content, to the Master of Biomedical Sciences offered at Colorado State University³ (see Appendix A). The CSU Master’s degree is a 1-year course-based program that focuses on basic sciences, similar in content to the current MSU Certificate program. The advantages of the proposed Master’s degree at MSU are 1) it offers a health and science related curriculum to students, 2) following a concentrated effort on the basic sciences, and 3) can be completed during a ‘glide’ year. In addition, participating students will benefit from being part of a cohort of students with similar goals, meanwhile being integrated into the full campus environment.

The Certificate program is currently capped at 20 students per year. We similarly will cap the Master’s program to 30 students per year, with an expectation that approximately one-half to two-thirds of the program will consist of continuing Certificate students and the remainder will be incoming 1-year students. The admission process will continue to be selective; therefore, the student cap may not be reached in the first several years of the program.

3. INSTITUTIONAL AND SYSTEM FIT

a. What is the connection between the proposed program and existing programs at the institution?

The Health Sciences Master’s degree program has the potential of being a fully independent degree program, but it also fits well with other programs offered at MSU-Bozeman. The Post Baccalaureate Pre-medical Certificate program consists of ~10-15 students/year that obtain the science pre-requisite courses for health professional school

admission and entrance exam success. Based on the timing of the Certificate program and the health professional school application process, these students (and other non-Certificate Post Bacc students) are non-degree seeking and have a ‘glide’ year following the program before potential matriculation into health professional schools. In addition, students who are currently attending MSU, but apply to health professional schools following their final undergraduate year have a similar ‘glide’ year. Many of the students in both of these categories have expressed an interest in the Master’s degree program. In addition to supplementing the education of students who will matriculate into health professional schools, the Master’s degree program will also improve the work force competitiveness of students who do not pursue health professional school opportunities.

b. Will approval of the proposed program require changes to any existing programs at the institution?

Approval of the Master of Science in Health Sciences degree program will not require changes to any existing programs at MSU-Bozeman.

c. Describe what differentiates this program from other, closely related programs at the institution.

The Master of Science Degree in Health Sciences will dovetail efficiently with the Post Baccalaureate Pre-Medical Certificate program, but the two programs have different priorities. The Certificate program is a ‘career-changing’ program, thereby supporting the educational needs of students with good academic performance but who otherwise lack a science-based foundation. Students in the Certificate program could apply to the Master’s degree program and obtain further health-related educational experiences. Alternatively, students who have met the science-based prerequisites for health professional schools may apply to the Master’s program to enhance and refresh their science-based experience, or to broaden that experience to other health-related and/or patient-centered courses.

d. How does the proposed program serve to advance the strategic goals of the institution?

The goals and objectives of the Master of Science degree in Health Sciences are fully consistent with each topic in the Montana State University mission statement:

- *To provide a challenging and richly diverse learning environment in which the entire university community is fully engaged in supporting student success.*
- *To provide an environment that promotes the exploration, discovery, and dissemination of new knowledge.*
- *To provide a collegial environment for faculty and students in which discovery and learning are closely integrated and highly valued.*
- *To serve the people and communities of Montana by sharing our expertise and collaborating with others to improve the lives and prosperity of Montanans.*

In accomplishing our mission, we remain committed to the wise stewardship of resources through meaningful assessment and public accountability.”

In addition, the program will contribute to the success and implementation of the MSU 5-yr strategic plan categories for Curriculum Development and Partnership and Outreach as described below.

Curriculum: *There will be increased opportunities for interdisciplinary courses and programs and encourage team teaching across all disciplinary boundaries.*

The Health Sciences Master of Science degree will provide the opportunity and encourage students to synthesize material across disciplinary boundaries from molecular and cellular biology to the ethics of patient care. Specifically, the proposed Master's program will facilitate and formalize a multidisciplinary and diverse educational experience. This program will offer students a unique opportunity to integrate their core knowledge in the basic sciences with an applied and person-centered curriculum related to health and health care. In addition, through the multidisciplinary approach of this program, a broader collection of the university community will be engaged in the educational success of the students interested in careers in the health care system.

Partnership and outreach: *The four-campus MSU family will be more integrated in its array of program offerings, research, outreach, and business services.*

Our goal for this program is to fully utilize the expertise that exists within the Montana University system. To that end, we will encourage students to take courses that are part of the University of Montana Master of Public Health program as well as the MSU-Billings Master of Health Administration. The addition of the proposed Health Sciences Master's program complements the current educational offerings throughout the Montana University System.

Furthermore, the Board of Regents defined as part of the 2006-2010 Strategic goals to; *1) Increase the overall educational attainment of Montanans through increased participation, retention, and completion rates in the Montana University System, 2) To assist in the expansion and improvement of the state's economy through the development of high value jobs and the diversification of the economic base, and 3) to improve institutional and system efficiency and effectiveness.*

A program to recruit, better prepare, and assist students to enter the health care workforce in Montana, either directly or following a professional school experience, will address the shortages that currently exist in the relatively high paying market of health care delivery (as defined by the Montana Healthcare Workforce Advisory Committee)¹. This pipeline program will assist and encourage students to obtain their educational foundation in Montana that will, in turn, increase the likelihood that they pursue a career in Montana. Finally, by utilizing the course content that already exists in the Montana University system, this program will broaden the application of existing courses and further enhance the effectiveness of the educational delivery system.

e. Describe the relationship between the proposed program and any similar programs within the Montana University System.

The Master of Science Degree in Health Sciences program does not have significant overlap with any program in the MUS system. In fact, there are a limited number of

similar programs in the region. The design of this program should nicely complement the Master degrees offered at University of Montana (MPH) and MSU-Billings (MHA).

4. Program Details

a. Provide a detailed description of the proposed curriculum.

The admission process will occur with a rolling admission beginning in November, and a deadline of March 31. Prerequisites will include 2 semesters of each: General Chemistry, Organic Chemistry, Physics and Biology. In addition, 1 semester each of Biochemistry, Calculus, Statistics, Psychology and Sociology will be highly recommended for matriculation into the Master's program. Certificate students will be conditionally accepted into the Master's program subject to successful completion of the Certificate program. A minimum GPA of 3.0 will be expected, but this requirement will be flexible to allow underserved and non-traditional students an opportunity to re-enter the educational process. Completion of the Master's program will culminate with an approved scholarly project based on a research experience, a case study, or a literature review. Recommended courses, based on Emphasis, is provided as appendix B. The Director of the Health Professions Advising office (Sheila Nielsen-Preiss, Ph.D.) will serve as the academic advisor for all students and will co-chair the graduate student committees. Currently, a tenure-track faculty member in the Division of Health Sciences and Department of Cell Biology and Neuroscience (Cassie Cusick, Ph.D.) has agreed to co-chair the graduate student committees. During the initial 'growth' years of the program, two faculty will be sufficient to chair the committees. As the program reaches maximum enrollment, we plan to recruit the support of additional faculty members that have been identified as instrumental in the educational process of this student cohort. The Health Professions Advising office will continue to support the applications to professional schools for all students carrying 12 or more credits in each of two semesters.

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

An anticipated start date for Master in Health Sciences program is Fall 2009. It is estimated that 5 of the current Certificate students would apply for admission. In addition, a small number of non-Certificate students (maximum of 5) may be admitted; therefore, during the first programmatic year we would anticipate a class of approximately 10. At the same time, we would be matriculating the incoming Certificate students (approx 15 students), many of whom will remain for the second year Master's program. In year 2 (2010) approximately half of the Certificate students will continue into the Master's degree, half will finish with the Certificate, and some new students will be admitted to the Master's degree directly. The Master's program will be capped at 30 students, but admission will follow a selective process as described in 4.a., therefore we do not anticipate reaching the cap until the program develops and is nationally promoted. By promoting a diverse curriculum, the impact on any given course or department should be kept to a minimum.

Academic year Program	2009		2010		2011	
	Certificate	Master's	Certificate	Master's	Certificate	Master's
# students	15	5+5	15	7+5	17	10+10

5. Resources – No new resources are being requested for the implementation of this program.

a. Will additional faculty resources be required to implement this program?

Additional faculty resources will not be required for the implementation of this program. The program will utilize established courses.

b. Are other, additional resources required to ensure the success of the proposed program?

Additional resources are not required to ensure the success of the proposed program. The infrastructure already exists to assist this type of student.

6. Assessment

How will the success of the program be measured?

Assessment will be evaluated by several criteria including size and qualifications of the applicant pool as well as the matriculating classes. In addition, we will maintain records of post-graduation placement to evaluate the success of the program at preparing students for matriculation into professional schools and/or into the health care workforce. These types of data analyses are already implemented in the office of Health Professions Advising for the Certificate students and the undergraduate cohort of students pursuing careers in health care.

This program will also maintain the high standards we expect from our students. Therefore, the Master's degree will only be awarded to students who meet the following criteria: conditionally accepted students must complete the Certificate program; students must complete at least 24 approved course credits and maintain a 3.0 GPA; and students must successfully complete a scholarly project.

7. Process Leading to Submission

Describe the process of developing and approving the proposed program.

The Master of Health Sciences program was conceptualized in the Division of Health Sciences and the office of Health Professions Advising. Upon establishing a program and curriculum template, Drs. Linda Hyman, Vice Provost for the Division of Health Sciences, and Sheila Nielsen-Preiss, Director of Health Professions Advising sought advice and input from Dr. Larry Baker, Dean of Health and Human Development, Dr. Paula Lutz, Dean of Letters and Sciences, and Dr. Elizabeth Nichols, Dean of Nursing. Upon the request of the Deans, we communicated with department chairs about the impact on specific courses, including Drs. Tim Dunnagan of HHD and Thom Hughes of CBN. Suggestions from these participants were integrated into the program design prior to submission to the Montana State University Graduate Advisory Council. We continue

to seek input from other department chairs and faculty. In addition, we provided the draft document to the University of Montana's Master in Public Health program and the Montana State University-Billings Master of Health Administration program. Following approval at the University level, the Master in Health Sciences program is being proposed to the Board of Regents.

8. References

1. HEALTHCARE WORKFORCE DEMAND IN MONTANA
A Report by the Montana Healthcare Workforce Advisory Committee, April 2007
2. <http://services.aamc.org/postbac/>
3. <http://www.cvmb.colostate.edu/bms/planB.htm>

January 7, 2009

ITEM 142-2002-R0109

Master of Arts and PhD in American Studies; Montana State University-Bozeman**THAT:**

The Board of Regents of Higher Education authorizes Montana State University Bozeman to establish Master of Arts and Doctor of Philosophy Degree Programs at Montana State University-Bozeman.

EXPLANATION:

Montana State University-Bozeman requests permission to establish Master of Arts and Doctor of Philosophy degree programs in American Studies. The graduate program in American Studies will be built on the following foundations: 1) the presence of a distinguished cohort of full-time and associated faculty with research and teaching expertise in the disciplines that provide the backbone for American Studies, namely, Anthropology, Architectural History, Art History, English, History, Museum Studies, Media and Theater Arts, Native American Studies, Political Science, and Sociology; 2) a unique Rocky Mountain setting that provides pioneering research opportunities for graduate students at such sites as the Museum of the Rockies, Renne Library's Department of Special Collections, the Yellowstone National Park archives (a satellite of the National Archives) located in Mammoth, Wyoming, the Montana State Historical Society archives in Helena, and the Cody Institute for Western American Studies at the Buffalo Bill Historical Center in Cody, Wyoming; 3) the interdisciplinary resources and faculty strengths of MSU. What will make this program truly world-class is that we will be offering joint graduate degrees with two of Europe's most prestigious American Studies programs at the universities of Amsterdam and Utrecht.

This program has been specifically designed to meet the needs of students who are interested in completing a high-quality graduate level program in American Studies, and who currently go to other institutions because MSU does not offer this degree. The program will prepare students for careers in academic research and teaching, business, journalism, cultural resource management, museums, or government service, especially in the U.S. Department of State (primarily its information and cultural services), the Foreign Service and agencies like the National Park Service. In short, graduate level training in American Studies positions students for multiple career options where depth and breadth of knowledge about American culture is essential. This program will draw top international students in the arts and humanities to MSU, allowing our students to develop international connections that are increasingly necessary for living out the future of the 21st century.

MONTANA BOARD OF REGENTS

LEVEL II REQUEST FORM

Item No.:	142-2002-R0109	Date of Meeting:	January 7, 2009
Institution:	Montana State University-Bozeman		
Program Title:	Master of Arts and PhD in American Studies		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

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- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

Montana State University-Bozeman requests permission to establish Master of Arts and Doctor of Philosophy degree programs in American Studies in the University College. The graduate program in American Studies will be built on the following foundations: 1) the presence of a distinguished cohort of full-time and associated faculty with research and teaching expertise in the disciplines that provide the backbone for American Studies, namely, Anthropology, Architectural History, Art History, English, History, Museum Studies, Media and Theater Arts, Native American Studies, Political Science, and Sociology; 2) a unique Rocky Mountain setting that provides pioneering research opportunities for graduate students at such sites as the Museum of the Rockies in Bozeman, Renne Library's Department of Special Collections, the Yellowstone National Park archives (a satellite of the National Archives) located in Mammoth, Wyoming, the Montana State Historical Society archives in Helena, and the Cody Institute for Western American Studies at the Buffalo Bill Historical Center in Cody, Wyoming; 3) the interdisciplinary resources and faculty strengths of MSU. What will make this program truly world-class is that we will be offering joint graduate degrees with two of Europe's most prestigious American Studies programs at the universities of Amsterdam and Utrecht.

This program has been specifically designed to meet the needs of students who are interested in completing a high-quality graduate level program in American Studies, and who currently go to other institutions because MSU does not offer a graduate degree program in American Studies. The program will prepare students for careers in academic research and teaching, business, journalism, cultural resource management, museums, or government service, especially in the U.S. Department of State (primarily its information and cultural services), the Foreign Service and agencies like the National Park Service.

**Master of Arts and Doctor of Philosophy Degree Programs
in American Studies at Montana State University**

1. OVERVIEW

Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The purpose of this proposal is to establish Master of Arts and Doctor of Philosophy degree programs in American Studies in University College at Montana State University. The graduate program in American Studies will be built on the following foundations: 1) the presence of a distinguished cohort of full-time and associated faculty with research and teaching expertise in the disciplines that provide the backbone for American Studies, namely, Anthropology, Architectural History, Art History, English, History, Museum Studies, Media and Theater Arts, Native American Studies, Political Science, and Sociology; 2) a unique Rocky Mountain setting that provides pioneering research opportunities for graduate students at such sites as the Museum of the Rockies in Bozeman, Renne Library's Department of Special Collections, the Yellowstone National Park archives (a satellite of the National Archives) located in Mammoth, Wyoming, the Montana State Historical Society archives in Helena, and the Cody Institute for Western American Studies at the Buffalo Bill Historical Center in Cody, Wyoming; 3) the interdisciplinary resources and faculty strengths of MSU. What will make this program truly world-class is that we will be offering joint graduate degrees with two of Europe's most prestigious American Studies programs at the universities of Amsterdam and Utrecht.

2. NEED

a. To what specific need is the institution responding in developing the proposed program?

This program has been specifically designed to meet the needs of students who are interested in completing a high-quality graduate level program in American Studies, and who currently go to other institutions because MSU does not offer a graduate degree program in American Studies. Interest in developing an interdisciplinary graduate program in American Studies extends across several departments in the College of Arts and Architecture and in the College of Letters and Science. Student interest in the proposed programs, as expressed especially by students in MSU's new undergraduate program in American Studies, supports the claim that there is a need to respond to student demand for graduate level training.

b. How will students and any other affected constituencies be served by the proposed program?

The program will prepare students for careers in academic research and teaching, business, journalism, cultural resource management, museums, or government service, especially in the U.S. Department of State (primarily its information and cultural services), the Foreign Service and agencies like the National Park Service. American Studies has long been one of the primary training grounds for American Foreign Service officers as well as journalists and business leaders who are charged with making sense of the American cultural mosaic for international audiences. Because of its strong international components, the MSU graduate program in American Studies will better position graduate students in many disciplines to think and work in a globalized political economy. In short, graduate level training in American Studies positions students for multiple career options where depth and breadth of knowledge about American culture is essential.

At universities in many nations around the world, American Studies is the rubric of choice for students seeking a broad understanding of American culture. Most of these students, when they think about doing graduate work at American universities, are drawn to institutions that offer advanced training in American Studies. Without a graduate level American Studies program, MSU is put at a disadvantage in trying to draw top international students in the arts and humanities to this institution. Having such a program will position us to draw students from long-established American Studies programs in Europe and more recently created programs in Asia. The end result will enable our students to develop international connections that are increasingly necessary for living out the future of the 21st century.

c. What is the anticipated demand for the program? How was this determined?

Based on discussions with department heads and advisors at MSU, and with our partner institutions in the Netherlands, it is anticipated that, in its initial stages, the program is likely to enroll fewer than 10 students annually, of whom 2-3 may be dual degree-seeking students from the universities of Amsterdam and Utrecht.

3. INSTITUTIONAL AND SYSTEM FIT

a. What is the connection between the proposed program and existing programs at the institution?

In 2007, MSU introduced an undergraduate program in American Studies. The proposed graduate program will enhance and directly benefit the new undergraduate curriculum. It will also complement the graduate programs in Architecture, Earth Sciences, English, History, Media and Theater Arts, and Native American Studies, providing an opportunity for graduate students in many disciplinary fields to interact and share their research interests.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

The proposed program will not require any significant changes to existing programs at MSU. Students from the program will enroll in graduate level courses in related departments, such as English and History, but the impact on enrollments in any one of those courses is likely to be very small.

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

Because American Studies is the interdisciplinary study of American culture, drawing on the insights of experts in various fields to better understand the rich and sometimes contentious traditions of the American experience, there are many closely related programs, such as Native American Studies. However, while the proposed program will draw on the research and teaching expertise of faculty in other departments, the curriculum itself will be unique, interdisciplinary in both its content and delivery.

d. How does the proposed program serve to advance the strategic goals of the institution?

In keeping with our mission statement, according to which MSU will provide “an environment that promotes the exploration, discovery, and dissemination of new knowledge,” this program promises to provide world-class graduate training at the M.A. and Ph.D. levels in American Studies for students interested in the interdisciplinary study of American culture. On a national level, the American Studies M.A. and Ph.D. degree programs will help define, and very quickly play a leadership role in, the globalization of American Studies. The joint-degree programs with the Universities of Amsterdam and Utrecht will be a mark of distinction for MSU and immediately make the program competitive for training and placing students in careers where deep knowledge of American cultural values is essential. It will draw a wider pool of exceptionally qualified graduate students to MSU, many of whom would serve as graduate teaching assistants across campus, thereby

improving the quality of undergraduate teaching. The program will also help to anchor MSU's continuing efforts to attract international students.

e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

Currently, there is no graduate training in American Studies in Montana. Other established programs in the region include Utah State University and the University of Wyoming, which offer M.A. degrees, and the University of Utah and Washington State University, which offer doctoral programs. It is important to emphasize that none of these programs offers our unique emphasis on understanding America, especially the American West, in the world, or joint-degree programs with leading European universities.

It is our understanding that the University of Montana also intends to establish a graduate program in American Studies at some time in the future. Accordingly, in November 2008, faculty and administrators from MSU and UM involved in the planning of these initiatives met to discuss our respective program goals and curricular objectives. The meeting was a very productive one, resulting in the identification of several ways in which we can actively collaborate in offering two first-class, but separate and distinct, graduate programs. Both parties feel that in this case, the two programs will complement each other and attract a greater number of domestic and international students.

4. PROGRAM DETAILS

a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

American Studies examines those values and institutional structures that hold Americans together and, at times, divide them into the kinds of factions that the authors of the *Federalist Papers* so feared when they argued for the ratification of the U.S. Constitution. How America is *constituted* really is the core subject of American Studies.

The major fields for the American Studies graduate program will be:

American Arts. America's visual and performing arts have shaped the substance of American culture from America's founding moments through the present – MSU faculty have expertise in the history of American media, theater, painting, sculpture, and music as well as more specialized mastery of the theoretical underpinnings of these disciplines.

American History. MSU has internationally recognized strengths in American history and its faculty offer courses from America's colonial period through the present. Many of the Department of History and Philosophy's courses are both synchronic and diachronic and therefore serve as perfect points of entry for an

interdisciplinary program like American Studies. Closely related to the discipline of history is the discipline of cultural geography. With its expertise in the history of western settlement patterns, the Earth Sciences Department also affords opportunities for collaboration.

American Literature. It is widely assumed that people around the world understand America only through its electronically mediated exports. At universities around the world, students study American literature to master the metaphoric and syntactic structures of American culture. At MSU, faculty offer both breadth and depth in literary theory and past and present American literature.

American Pluralism. America is often described as a “nation of nations,” comprised of immigrants drawn from the divergent cultures of the globe. Students who focus on American pluralism will draw on the expertise of faculty in Anthropology, Latin American Studies, Native American Studies, Religious Studies, and Women’s Studies.

Public History. Public History is a discipline dedicated to the application of cultural criticism to museums, historical sites, and heritage tourism. The Department of History and Philosophy is home to MSU’s Museum Studies Minor, a thriving “applied studies” program dedicated to preparing students for work in the museum field. At the graduate level, students would have the opportunity to develop research interests and critical theory dedicated to better understanding the role of museums in American culture.

Course of Study

Master of Arts Program

The Master of Arts degree will require completion of 30 credits, of which no more than 9 can be at the 400-level. It will include an all course-work (Plan A) option, and a 10-credit Master’s Thesis (Plan B) option. All students will be required to take two new proposed courses, AMST 5XX/6XX, Methods in American Studies, and AMST 5XX/6XX, Research and Writing in American Studies. Additional course work will be selected from the list of courses below. Qualified students will be allowed to enter the Master of Arts program after completing three years of undergraduate course work (five-year M.A.). Students who enter the program after

receiving their baccalaureate degree would normally require two years of full-time work to complete it. The program will follow all of the guidelines of the Division of Graduate Education.

Doctor of Philosophy Program

The Doctor of Philosophy program will be built upon research and intensive course work that will normally require four years of full-time work. It will be based on students selecting an area of specialization from one of the fields described above (American Arts, American History, American Literature, American Pluralism, Public History). All doctoral students will be required to take two new proposed courses, AMST 5XX/6XX, Methods in American Studies, and AMST 5XX/6XX, Research and Writing in American Studies. Additional coursework will be selected from the list of courses below. Other requirements of the Doctor of Philosophy program will include the following:

- 1) A B.A. or M.A. in American Studies or a closely related field.
- 2) At least two years of full-time study at MSU.
- 3) Completion of a minimum of 60 credit hours post-baccalaureate, of which at least 18 must be dissertation credits. A maximum of 30 credits from a previously earned master's degree (from MSU or another accredited University) may be applied toward the 60 credit minimum required for the doctoral degree.
- 4) Successful completion of a foreign language examination (American Indian languages would be considered as meeting this requirement). In the case of international students whose first language is not English, a score of 550 or higher on the TOEFL will be considered to have satisfied the language requirement.
- 5) Declaration of a major field and a supporting area by the third semester of graduate study.
- 6) The major field will normally require at least 12 credits of coursework. The major fields are: American Arts, American History, American Literature, American Pluralism, and Public History.
- 7) The supporting area will be acquired through three courses (9 credits) and a four-hour written examination administered by the supporting area advisor. The supporting area will be a thematic field, for example, Latin American Studies, Native American Studies, Technology and Culture, or Women's Studies.
- 8) Submission of a "dissertation prospectus" after the fourth semester of full-time graduate study beyond the Master's level.
- 9) Mastery of the major field would be determined by the dissertation; a record of excellence in all courses; submission of a "syllabus requirement," in which the student would design and defend a detailed course syllabus in their major field, or submit another applied exercise, such as the design of a museum exhibit; a four-hour comprehensive written exam; a two-hour oral comprehensive exam.
- 10) Submission of a dissertation that makes an original contribution to the major field of study, and that is defended in a public forum or "dissertation defense."

Minor in American Studies

Graduate students in other programs at MSU may acquire a minor in American Studies by completing AMST 5XX/6XX, Methods in American Studies, AMST 5XX/6XX, Research and Writing in American Studies, and 9 additional credits selected from the from the list of courses below.

Courses

AMST 401, Seminar in American Studies
 AMST 5XX/6XX, Methods in American Studies*
 AMST 5XX/6XX, Research and Writing in American Studies*
 ARCH 425, Western Architectural History
 ART 419, 20th Century Art
 ART 450, Contemporary Art
 ART 463, 19th Century Art
 ENGL 414, Literature of Place
 ENGL 420, Critical Theory
 ENGL 431, Studies in a Major Author

ENGL 441, Studies in Emergent Literatures
 ENGL 510, Studies in Critical Theory and Practice
 ENGL 540, Studies in Theory and Practice of Literary History
 GEOG 401, Historical Geography
 GEOG 503, Settlement Geography
 HIST 402, Trans-Mississippi West
 HIST 403, Gender in the U.S. and Canadian West
 HIST 404, Montana and the West
 HIST 406, Anti-Communism in the Truman-Eisenhower Years
 HIST 408, Gender in America
 HIST 412, Race and Class in America
 HIST 422, History of the American Constitution
 HIST 447, History of the North American Indian
 HIST 455, History of American Technology
 HIST 456, American Thought and Culture
 HIST 457, Museum History
 HIST 464, History of Yellowstone
 HIST 466, U.S. Environmental History
 HIST 502, Public History
 HIST 503, History of America Before 1860
 HIST 505, U.S. History 1860 to Present
 HIST 513, Topics in Social and Cultural History
 HIST 515, The American West
 MTA 504, Film and Documentary Theory
 NAS 405, Gender Issues in Native American Studies
 NAS 415, Native Food Systems
 NAS 425, Pan-Indianism in American Society
 NAS 430, American Indian Education
 NAS 520, Feminist and Gender Theories in Native American Studies
 NAS 521, Tribal Government: Yesterday and Today
 NAS 523, American Indians and Minorities in Higher Education
 NAS 524, Contemporary Issues in American Indian Studies
 NAS 525, Indigenous Philosophies of Sacred Ecologies
 NAS 530, Federal Indian Law and Policy
 NAS 540, Theoretical Positions in Native American Studies
 NAS 541, A Critical Approach to NAS Methodologies
 NAS 560, Native American Literary Traditions
 POLS 409, Constitutional Law and Public Policy
 POLS 415, Montana Local Politics and Policy
 POLS 452, American Public Policy
 SOC 427, Sociological Analysis
 SOC 445, Sociology of Religion

*Proposed new courses

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

The program would begin enrolling students in Fall 2009. It is estimated that 5-10 students would be admitted annually.

5. RESOURCES

a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No new faculty positions will be required. The reassignment of faculty to provide for the teaching of the two new proposed courses (AMST 5XX/6XX, Methods in American Studies, and AMST 5XX/6XX, Research and Writing in American Studies) will be coordinated by University College.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Library resources are adequate to support graduate level work in American Studies. Many professional journals are now available online, through JSTOR and WorldCAT. Special Collections services, the archives in Yellowstone National Park, and the materials collections housed at the Museum of the Rockies and the Cody Institute for Western American Studies at the Buffalo Bill Historical Center in Cody, Wyoming will afford students the opportunity to carry out meaningful original research.

The impact of the program on facilities will be marginal. Shared office space for GTA's may be available through the Humanities Institute.

6. ASSESSMENT

How will the success of the program be measured?

The primary responsibility for assessment of this program will lie with the Program Director. Formative and summative data will be gathered from the two new proposed courses, AMST 5XX/6XX, Methods in American Studies, and AMST 5XX/6XX, Research and Writing in American Studies. The data will be used to guide programmatic changes (i.e., changes in the curriculum that will affect all future students).

7. PROCESS LEADING TO SUBMISSION

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

Development of this proposal was spearheaded by two faculty members, David Cherry, Professor of History and Director of the American Studies Program, and Robert Rydell, Professor of History and Director of the Humanities Institute. They developed a written proposal, which was widely circulated among faculty and department heads in the College of Arts and Architecture and the College of Letters and Science. A revised version of the proposal was then submitted to the Graduate Council, which approved it, unanimously, in April 2008.

ITEM 142-1001-R0109

Approval to Create a 2+2 Engineering Program

THAT:

The University of Montana – Missoula proposes to establish a 2+2 engineering program in collaboration with Montana Tech of the University of Montana to better serve the needs of the students who are currently participating in the Pre-Engineering Program at the University of Montana – Missoula. Students in the Pre-Engineering Program come to UM with the intention of spending two years at UM before transferring to an engineering school. Many of these students make the choice to start at UM for financial reasons. Establishing this 2+2 Program will ease the transfer process for these students.

EXPLANATION:

Suggested courses of study have been developed for all of the engineering degrees offered by Montana Tech (Electrical Engineering, Environmental Engineering, General Engineering, Geological Engineering, Geophysical Engineering, Metallurgical & Materials Engineering, Mining Engineering, and Petroleum Engineering). In this program students would take the first two years of courses at the University of Montana – Missoula and the last two years of courses at Montana Tech in Butte.

ATTACHMENTS:

Programs of Study
Letter of support

M O N T A N A B O A R D O F R E G E N T S
LEVEL II REQUEST FORM

Item No.:	142-1001-R0109	Date of Meeting:	January 7-8, 2009
Institution:	The University of Montana - Missoula		
Program Title:	2+2 Engineering Program		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

The University of Montana – Missoula proposes to establish a 2+2 engineering program in collaboration with Montana Tech of the University of Montana. Suggested courses of study have been developed for all of the engineering degrees offered by Montana Tech (Electrical Engineering, Environmental Engineering, General Engineering, Geological Engineering, Geophysical Engineering, Metallurgical & Materials Engineering, Mining Engineering, and Petroleum Engineering). In this program students would take the first two years of courses at the University of Montana – Missoula and the last two years of courses at Montana Tech in Butte.

A Proposal for a 2+2 Engineering Program**1. Overview**

The University of Montana – Missoula proposes to establish a 2+2 engineering program in collaboration with Montana Tech of the University of Montana. Suggested courses of study have been developed for all of the engineering degrees offered by Montana Tech (Electrical Engineering, Environmental Engineering, General Engineering, Geological Engineering, Geophysical Engineering, Metallurgical & Materials Engineering, Mining Engineering, and Petroleum Engineering). In this program students would take the first two years of courses at the University of Montana – Missoula and the last two years of courses at Montana Tech in Butte.

2. Need

The 2+2 Engineering Program will better serve the needs of the students who are currently participating in the Pre-Engineering Program at the University of Montana – Missoula. Students in the Pre-Engineering Program come to UM with the intention of spending two years at UM before transferring to an engineering school. Many of these students make the choice to start at UM for financial reasons. These students take math and physics courses along with a selection of general education courses. This works fairly well for some engineering disciplines and not at all for other disciplines. By establishing this 2+2 Engineering Program, the requirements for all of the engineering disciplines will be readily available to the students along with which courses they should take at UM. Establishing this 2+2 Program will ease the transfer process for these students. The students enrolled in the Pre-Engineering Program also establish the demand for the 2+2 Program. Currently there are 44 students enrolled in the Pre-Engineering Program at UM.

3. Institutional and System Fit

The proposed 2+2 Engineering Program will enhance and clarify the existing Pre-Engineering Program. The Pre-Engineering Program is the only program on the UM-Missoula campus that will be affected. For the engineering programs at MT Tech, the transfer students they receive from UM-Missoula will be better prepared and more knowledgeable of the engineering degree requirements. The long term result may also be that rather than transfer to an out-of-state engineering program (as some of the Pre-Engineering majors do now) more students will transfer with the Montana University System to complete their degree.

4. Program Details

Details of the proposed catalog language, including proposed courses of study, are attached separately. Our plan is to begin implementation of the 2+2 Engineering Program in Fall 2009. For the first year, we expect approximately 10 students to enter the program. In future years, we expect between 15 and 20 students to enter the program each year. This estimate is based on the number of Pre-Engineering majors currently enrolled at UM-Missoula.

5. Resources

Currently, the UM-Missoula offers two engineering courses for Pre-Engineering Program. These courses are taught by an adjunct assistant professor. To more securely establish the 2+2 Engineering Program, the funding for these courses should be in the base budget. The program also requires that one course currently taught every other year in the Department of Physics and Astronomy (PHYS 330 Methods of Communicating Physics) be offered every year. This is a writing class and will satisfy a technical writing criteria for the MT Tech engineering programs.

6. Assessment

The effectiveness of this program will be measured by the number of students enrolling in this program and their success upon transferring to MT Tech of the University of Montana.

7. Process Leading to Submission

Members of the Department of Physics and Astronomy (the home department of the Pre-Engineering Program) had discussions with President George Dennison about the possibility of establishing a more formal 2+2 Engineering Program. Professor Andrew Ware, chair of the Department of Physics and Astronomy, Adjunct Assistant Professor Maureen McGraw, Pre-Engineering advisor, Dean Gerald Fetz and Provost Royce Engstrom met in the Spring of 2008 to establish a plan for determining the

requirements for the program. Adjunct Assistant Professor McGraw collaborated with the faculty of the school of the School of Mines and Engineering of MT Tech to establish courses of study for all of the engineering disciplines at MT Tech. Finally, this proposal was written by Adjunct Assistant Professor McGraw and Professor Ware.

Pre-Engineering**Maureen McGraw, Advisor****Eijiro Uchimoto (Professor of Physics), Advisor**

The pre-engineering program at the University of Montana is a two year program that helps students determine if they are interested in engineering and prepares them to transfer to a University with an accredited engineering program. The exact curriculum a student would take varies between the different Engineering disciplines and the transfer school of interest. In general, the program focuses on developing a fundamental knowledge of physics, chemistry, and mathematics. In addition, students would take classes in English, communication, the social sciences, and humanities. Students in the pre-engineering program can transfer to a University of their choice. Students may be admitted to the 2 + 2 engineering program between the University of Montana and Montana Tech upon meeting the admission requirements. A student admitted to the program completes two years of study at the University of Montana and then completes their degree at Montana Tech.

Admission Requirements for 2+2 Engineering Program

To be admitted to the 2+2 Engineering Program with Montana Tech, a student must satisfy the following requirements:

1. Overall G.P.A. of 2.5
2. Completion of MATH 121 or placement into MATH 152
3. Completion of ENEX 100 or placement into ENEX 101

Students who intend to complete the 2+2 with Montana Tech, but have not yet met the above requirements will be admitted as pre-engineering majors. Students interested in pursuing an engineering degree at an engineering school other than Montana Tech will also be admitted into the pre-engineering program.

Students entering into the 2+2 Engineering Program choose an engineering discipline among the following choices: Electrical Engineering, Environmental Engineering, General Engineering, General Engineering with a Mechanical Engineering Option, General Engineering with a Civil Engineering Option, Geological Engineering, Geophysical Engineering, Metallurgical & Materials Engineering, Mining Engineering, and Petroleum Engineering. The courses to be taken at the University of Montana vary depending on the discipline chosen.

Suggested Course of Study for each engineering major

Bachelor of Science with a Major in Electrical Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		MATH 221	Linear Algebra	4	
PHYS 211	Fundamentals of Physics	4		MATH 251	Calculus III	4	
PHYS 213	Physics lab I	1		CHEM 161	General Chemistry	5	
PHYS 175	Intro. to Engineering	3		PHYS 321	Electronics for Scientist	3	
ENEX 101	Composition	3					
	Approved Elective	<u>2</u>					
		17				16	

Freshman		Winter Session		Sophomore		Winter Session	
	Humanities Elective	3			Humanities Elective	3	
		<u>3</u>				<u>3</u>	

Freshman		Spring Semester		Sophomore		Spring Semester	
MATH 153	Calculus II	4		MATH 341	Probability and Statistics	3	
PHYS 212	Fundamentals of Physics	4		CHEM 162	General Chemistry	5	
PHYS 214	Physics lab II	1		PHYS 295	Engineering Statics	3	
ECON 111	Microeconomics	3		PHYS 330	Communicating Physics	3	
	Social Science Elective	3					
	Approved Elective	<u>3</u>					
		18				14	

credits towards degree

3rd and 4th Years at Montana Tech

Junior			Senior		
CS 2136	Matlab Programming	3	CS 2156	Embedded Systems Dev.	3
CS 2146	C Programming	3	EE 4410	Cont. Sys. Theory & Des.	3
EE 2530	Electric Circuits	3	EE 4440	Communication Systems	3
EE 2550	Electric Circuits Lab	1	EE 4920	Engineering Design I	2
EE 3540	Electric Machines	3	EE 4930	Engineering Design II	1
EE 3550	Circuits II	4	ENGR3260	Fluid Mechanics	3
EE 3580	Signals & Systems	3	ENGR3340	Thermodynamics I	3
EE 3270	Digital Circuit Design	3	ENGR4040	Professional Engineering	1
EE 3570	Electronic Design	4	ENGR4940	Engineering Seminar	1
ENGR1050	Intro to General Eng.	1	MEC 3630	Engineering Economy	3
ENGR2060	Engineering Dynamics	3		Professional electives	<u>10</u>
MATH2236	Differential Equations	3			33
PHYS4056	Electricity and Magnetism	<u>3</u>			
		37			

Bachelor of Science with a Major in Environmental Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		MATH 251	Calculus III	4	
PHYS 211	Fundamentals of Physics	4		CHEM 161	General Chemistry	5	
PHYS 213	Physics lab I	1		GEOS 480	Hydrogeology	4	
PHYS 175	Intro. to Engineering	3		BIOL 221	Cell and Molecular Biology	4	
ENEX 101	Composition	3					
	Humanities Elective	3					
			<u>18</u>				<u>17</u>
Freshman		Winter Session		Sophomore		Winter Session	
	Humanities Elective	3			Social Science Elective	3	
			<u>3</u>				<u>3</u>
Freshman		Spring Semester		Sophomore		Spring Semester	
BIOL 100	Principles of Biology	4		MATH 341	Probability and Statistics	3	
GEOS 100	General Geology	2		CHEM 162	General Chemistry	5	
GEOS 101	General Geology Lab	1		PHYS 295	Engineering Statics	3	
MATH 153	Calculus II	4		EVST 302	Environmental Regulations	3	
PHYS 212	Fundamentals of Physics	4		PHYS 330	Communicating Physics	3	
PHYS 214	Physics lab II	1					
			<u>16</u>				<u>17</u>

3rd and 4th Years at Montana Tech

Junior				Senior			
CHEM2216	Survey of Organic Chem.	3		ENVE 4030	Water & Waste Water Tre.	3	
ECON2606	Principles of Economics	3		ENVE 4040	Surface Water Quality	3	
ENVE1940	Environmental Seminar	1		ENVE 4140	Land & Stream Restoration	3	
ENVE1060	Environmental Software	2		ENVE 4160	Environmental Permitting	1	
ENVE1180	Environmental Sampling I	1		ENVE 4190	Air Pollution Engineering II	3	
ENVE2040	Environ. Proc. Engineering	3		ENVE 4210	Risk Analysis	2	
ENVE2170	Environmental Sampling II	1		ENVE 4300	Soil & Subsurface Rem.	3	
ENVE3130	Air Diffusion Modeling	3		ENVE 4400	Pollution Prevention	2	
ENVE4020	Surface Water Hydrology	3		ENVE 4500	Sustain. Env. Qual. Mg.	2	
ENVE4180	Air Pollution Engineering	3		ENVE 4810	Environmental Design I	1	
ENVE4290	Hazardous Waste Engr.	3		ENVE 4820	Environmental Design II	2	
ENGR3260	Fluid Mechanics	3		ENVE 4940	Environmental Seminar II	1	
ENGR3350	Mechanics of Materials	3		ENGR3340	Thermodynamics I	3	
MATH2236	Differential Equations	3		MEC 3630	Engr. Econ. & Fin. Mgmt.	3	
			<u>35</u>				<u>32</u>

Bachelor of Science with a Major in General Engineering

Freshman			Fall Semester			Sophomore			Fall Semester		
MATH 152	Calculus I	4	MATH 251	Calculus III	4						
PHYS 211	Fundamentals of Physics	4	CHEM 161	General Chemistry	5						
PHYS 213	Physics lab I	1		Social Science Elective	3						
PHYS 175	Intro. to Engineering	3		Humanities Elective	3						
ENEX 101	Composition	3	MATH 221 or 341	Math Elective	3						
		15			18						

Freshman			Spring Semester			Sophomore			Spring Semester		
MATH 153	Calculus II	4	MATH 341	Probability and Statistics	3						
PHYS 212	Fundamentals of Physics	4	CHEM 162	General Chemistry	5						
PHYS 214	Physics lab II	1	PHYS 295	Engineering Statics	3						
ECON 111	Microeconomics	3		Humanities Elective	3						
GEOS 100/101	General Geology and Lab	3		Approved Elective	3						
		15			17						

3rd and 4th Years at Montana Tech

Junior			Fall Semester			Senior			Fall Semester		
CS 2146	C Programming	3	ENGR4040	Professional Engineering	1						
ENGR1050	Intro. to Gen. Engineering	1	ENGR4450	Instrumentation & Control	3						
ENGR2060	Engineering Dynamics	3	ENGR4460	Instrument. & Control Lab	1						
ENGR2150	Engineering Graphics	2	ENGR4940	Engineering Seminar	1						
ENGR2530	Electric Circuits	3	ENGR4920	Engineering Design I	2						
ENGR2550	Electric Circuits Lab	1	ENGR4930	Engineering Design II	1						
ENGR3210	Technical Writing	3	MEC 3630	Engineering Economy	3						
ENGR3260	Fluid Mechanics	3		Professional Electives	20						
ENGR3280	Fluid Mechanics Lab	1									
ENGR3340	Thermodynamics I	3									
ENGR3350	Mechanics of Materials	3									
ENGR3360	Mechanics of Materials Lab	1									
MATH2236	Differential Equations	3									
METE2020	Survey of Mat. Engineering	3									
	Professional Electives	3									
		36			32						

Bachelor of Science with a Major in General Engineering and an Option in Civil Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		MATH 251	Calculus III	4	
PHYS 211	Fundamentals of Physics	4		CHEM 161	General Chemistry	5	
					Hydrogeology (Prof. Elect.)	4	
PHYS 213	Physics lab I	1		GEOS 480	Humanities Elective	3	
PHYS 175	Intro. to Engineering	3					
ENEX 101	Composition	3					
			15				16

Freshman		Spring Semester		Sophomore		Spring Semester	
MATH 153	Calculus II	4		MATH 341	Probability and Statistics	3	
PHYS 212	Fundamentals of Physics	4		CHEM 162	General Chemistry	5	
PHYS 214	Physics lab II	1		PHYS 295	Engineering Statics	3	
ECON 111	Microeconomics	3			Approved Elective	3	
GEOS 100	General Geology	2			Social Science Elective	3	
GEOS 101	General Geology Lab	1					
	Humanities Elective	3					
			18				17

3rd and 4th Years at Montana Tech

Junior		Fall Semester		Senior		Fall Semester	
ENVE 2040	Introduction Env. Engineering	3		ENVE4020	Surface Water Hydrology	3	
ENGR 1050	Intro to General Engineering	1		ENGR2530	Electric Circuits	3	
ENGR 2060	Engineering Dynamics	3		ENGR2550	Electric Circuits Lab	1	
ENGR 2150	Engineering Graphics	2		ENGR3260	Fluid Mechanics	3	
ENGR 2300	Construction Estimating	3		ENGR3280	Fluid Mechanics Lab	1	
ENGR 3150	Intro Engineering Comp. Appl.	2		ENGR4040	Professional Engineering	1	
					Soil Mech. & Found.		
ENGR 3210	Technical Writing	3		ENGR4860	Des.	3	
ENGR 3340	Thermodynamics I	3		ENGR4870	Des. of Subdivisions/Lab	3	
ENGR 3350	Mechanics of Materials	3		ENGR4940	Engineering Seminar	1	
ENGR 3360	Mechanics of Materials Lab	1		ENGR4920	Engineering Design I	2	
ENGR 4880	Structural Analysis Rein. Conc.	3		ENGR4930	Engineering Design II	1	
MATH 2236	Differential Equations	3			Professional Electives	13	
	Survey of Materials						
METE 2020	Engineering	3		MEC 3630	Engineering Economy	3	
MIN 2100	Plane Surveying	3					
			36				35

Bachelor of Science with a Major in General Engineering and an Option in Mechanical Engineering

Freshman	Fall Semester		Sophomore	Fall Semester	
MATH 152	Calculus I	4	MATH 221	Linear Algebra	4
PHYS 211	Fundamentals of Physics	4	MATH 251	Calculus III	4
PHYS 213	Physics lab I	1	CHEM 161	General Chemistry	5
PHYS 175	Intro. to Engineering	3		Approved Elective	3
ENEX 101	Composition	3		Humanities Elective	3
		<u>15</u>			<u>15</u>

Freshman	Spring Semester		Sophomore	Spring Semester	
MATH 153	Calculus II	4	MATH 341	Probability and Statistics	3
PHYS 212	Fundamentals of Physics	4	CHEM 162	General Chemistry	5
PHYS 214	Physics lab II	1	PHYS 295	Engineering Statics	3
ECON 111	Microeconomics	3		Approved Elective	3
	Humanities Elective	3		Social Science Elective	3
		<u>15</u>			<u>17</u>

3rd and 4th Years at Montana Tech

Junior	Fall Semester		Senior	Fall Semester	
CS	Approved Computer Course	3	ENGR 3260	Fluid Mechanics	3
ENGR 1050	Intro to General Engineering	1	ENGR 3280	Fluid Mechanics Lab	1
ENGR 2060	Engineering Dynamics	3	ENGR 3540	Electric Machines	3
ENGR 2150	Engineering Graphics	2	ENGR 4020	Mechanical Engr. Lab	1
ENGR 2530	Electric Circuits	3	ENGR 4040	Professional Engineering	1
ENGR 2550	Electric Circuits Lab	1	ENGR 4340	Thermodynamics II	3
ENGR 3150	Intro Engr. Computer Appl.	2	ENGR 4450	Process Instr. & Control	3
ENGR 3210	Technical Writing	3	ENGR 4460	Proc. Instr. & Control Lab	1
ENGR 3340	Thermodynamics I	3	ENGR 4570	Kinematics	3
ENGR 3350	Mechanics of Materials	3	ENGR 4940	Engineering Seminar	1
ENGR 3380	Heat Transfer	3	ENGR 4920	Engineering Design I	2
ENGR 3360	Mechanics of Materials Lab	1	ENGR 4930	Engineering Design II	1
	Professional Elective	5		Professional Electives	9
MATH 2236	Differential Equations	3	MEC 3630	Engineering Economy	3
METE 2020	Survey of Materials Engr.	3			
		<u>39</u>			<u>35</u>

Bachelor of Science with a Major in Geological Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		MATH 251	Calculus III	4	
PHYS 211	Fundamentals of Physics	4		CHEM 161	General Chemistry	5	
PHYS 175	Intro. to Engineering	3		GEOS 330	Structural Geology	3	
ENEX 101	Composition	3		GEOS 480	Hydrogeology	4	
GEOS 100/101	General Geology and Lab	3					
		<u>17</u>				<u>16</u>	

Freshman		Winter Session		Sophomore		Winter Session	
ECON 111	Microeconomics	3			Humanities Elective	3	
		<u>3</u>				<u>3</u>	

Freshman		Spring Semester		Sophomore		Spring Semester	
MATH 153	Calculus II	4		MATH 341	Probability and Statistics	3	
PHYS 212	Fundamentals of Physics	4		CHEM 162	General Chemistry	5	
ECON 112	Macroeconomics	3		PHYS 295	Engineering Statics	3	
GEOS 226	Earth Materials	4		PHYS 330	Communicating Physics	3	
		<u>15</u>			Humanities Elective	3	
						<u>17</u>	

3rd and 4th Years at Montana Tech

Junior			Senior		
ENGR	Fundamental Engr. Elec.	3	ENGR	Fundamental Engr. Elec	6
ENGR 3260	Fluid Mechanics	3	ENGR 4040	Professional Engineering	1
ENGR 3350	Mechanics of Materials	3	GEOE	Electives	16
GEOE 1040	Intro to Geologic Engr.	1	GEOE 4140	Mining Geology	3
GEOE 2030	Into to Field Geology	1	GEOE 4300	Design Project	3
GEOE 2570	Sedimentology & Pet Geol.	3			
GEOE 4120	Engineering Geology	3			
GEOE 3020	Elements of Geophysics	3			
MATH 2236	Differential Equations	3			
MEC 3630	Engr. Econ. & Fin. Mgmt	3			
MIN 1520	Mapping, Surf Mod & Vol.	3			
MIN 2100	Plane Surveying	3			
MIN 4670	Geomechanics	3			
		<u>35</u>			<u>29</u>

Summer between Junior and Senior Year

GEOE 4210	Field Geology & Geophysics	6
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Bachelor of Science with a Major in Geophysical Engineering

Freshman	Fall Semester		Sophomore	Fall Semester	
MATH 152	Calculus I	4	MATH 251	Calculus III	4
PHYS 211	Fundamentals of Physics	4	CHEM 161	General Chemistry	5
PHYS 213	Physics lab I	1	MATH 221	Linear Algebra	4
PHYS 175	Intro. to Engineering	3	PHYS 321	Electronics for Scientist	3
ENEX 101	Composition	3			
GEOS 100/101	General Geology and Lab	3			
		<u>18</u>			<u>16</u>

Freshman	Winter Session		Sophomore	Winter Session	
	Humanities Elective	3		Humanities Elective	3
		<u>3</u>			<u>3</u>

Freshman	Spring Semester		Sophomore	Spring Semester	
MATH 153	Calculus II	4	PHYS 330	Communicating Physics	3
PHYS 212	Fundamentals of Physics	4	CHEM 162	General Chemistry	5
PHYS 214	Physics lab II	1	PHYS 295	Engineering Statics	3
ECON 111	Microeconomics	3	MATH 341	Probability and Statistics	3
GEOS 226	Earth Materials	4		Social Science Elective	3
		<u>16</u>			<u>17</u>

3rd and 4th Years at Montana Tech

Junior			Senior		
CS	Computer Science Elective	3	ENGR 4040	Professional Engineering	1
ENGR	Engineering Elective	3	GEOE	Electives	6
GEOE 3030	Structural Geology	3	GEOE 4010	Intro. Seismic Prospecting	3
GEOE 1010	Intro. to Geophysics	1	GEOE 4080	Seismic Prospecting	3
GEOE 1020	Intro. to Geophysics II	1	GEOE 4100	Electrical Prospecting	3
GEOE 3020	Elements of Geophysics	3	GEOE 4500	Inversion: Exper. Des. & Int.	3
GEOE 2250	Physics of the Earth	3	GEOE 4750	Geophysical Engr. Design	3
GEOE 4120	Gravity & Magnetic Expl.	3	MEC 3630	Engr Econ & Financial Mgmt	3
GEOE 4460	Applied Linear Systems	3			
MATH 2236	Differential Equations	3			
MIN 2100	Plane Surveying	3			
PHYS 4536	Methods of Theor. Physics	3			
		<u>32</u>			<u>25</u>

Summer between Junior and Senior Year

GEOE 4210	Field Geology & Geophys.	6
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Bachelor of Science with a Major in Metallurgical & Materials Engineering

Freshman	Fall Semester		Sophomore	Fall Semester	
MATH 152	Calculus I	4	MATH 251	Calculus III	4
CHEM 161	General Chemistry	5	CHEM 222*	Organic Chemistry I	3
PHYS 175	Intro. to Engineering	3	CHEM 224*	Organic Chemistry I Lab	2
ENEX 101	Composition	3	PHYS 211	Fundamentals of Physics	4
	Humanities Elective	3	PHYS 213	Physics lab I	1
				Social Science Elective	3
		<u>18</u>			<u>17</u>

Freshman	Spring Semester		Sophomore	Spring Semester	
MATH 153	Calculus II	4	MATH 341	Probability and Statistics	3
CHEM 162	General Chemistry	5	PHYS 295	Engineering Statics	3
ECON 111	Microeconomics	3	PHYS 212	Fundamentals of Physics	4
	Humanities Elective	3	PHYS 214	Physics lab II	1
			CHEM 370*	Applied Physical Chemistry	3
		<u>15</u>			<u>14</u>

* Technical Elective assuming Chemistry Minor, other options available

3rd and 4th Years at Montana Tech

Junior			Senior		
CHEM 3176*	Analytical Chem.I	4	ENGR 2530	Electrical Circuits & Power	3
ENGR 3350	Mechanics of Mat.	3	ENGR 2550	Electrical Circuits & Power Lab	1
ENGR 3360	Mech. of Mat. Lab	1	ENGR 3210	Technical Writing	3
MATH 2236	Diff. Equations	3	ENGR 4040	Professional Engineering	1
METE 1940	Freshman Seminar	1	MEC 3630	Engr Econ & Financial Mgmt	3
METE 2320	Proc. of Part. Sys.	2	METE 4050	Aqueous & Elev. Temp. Proc. Lab	1
METE 2330	Design of Part. Sys.	2	METE 4920	Senior Design I	1
METE 2340	Part. Proc. Lab I	1	METE4940W	Senior Seminar	1
METE 2350	Part. Proc. Lab II	1			
METE 2500	Trans. Phen. & Des.	2	M&ME 4020	Proc. of Elevated Temp Systems	3
			M&ME 4230/	Multicomp. Phase Diagrams <i>or</i>	
M&ME 2510	Intro. to M. & Ph. M.	2	M&ME 4410	Met. & Mat. Flowsheet Design	3
M&ME 3220	Met & Mat Thermo.	3	M&ME 4510	Process Instrumentation & Control	3
M&ME 3510	Fund. of Materials	2	M&ME 4620	Ceramic Materials	2
M&ME 3530	Micro. Interpretation	1	M&ME 4750	Enviro. Degradation of Materials	3
M&ME 3520	Mat. Engr. & Design	2	M&ME 4860	Polymeric Materials	3
M&ME 3540	Mat. & Ph. Met. Lab	1	METE4930W	Senior Design II	2
M&ME 4500	Adv. Trans. P. & D.	2		Track B or A	3
M&ME 4710	Mat. Char. & An.	3			
	Track A or B Elec.	3			
		<u>39</u>			<u>36</u>

Bachelor of Science with a Major in Mining Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		CHEM 161	General Chemistry	5	
PHYS 211	Fundamentals of Physics	4		ECON 112	Macroeconomics	3	
PHYS 213	Physics lab I	1		MATH 251	Calculus III	4	
PHYS 175	Intro. to Engineering	3		MATH 341	Probability and Statistics	3	
ENEX 101	Composition	3			Mining Elective	3	
GEOS 100	General Geology	2					
GEOS 101	General Geology Lab	1					
		<u>18</u>				<u>18</u>	

Freshman		Spring Semester		Sophomore		Spring Semester	
MATH 153	Calculus II	4		CHEM 162	General Chemistry	5	
PHYS 212	Fundamentals of Physics	4		PHYS 295	Engineering Statics	3	
PHYS 214	Physics lab II	1		PHYS 330	Communicating Physics	3	
ECON 111	Microeconomics	3			Humanities Elective	3	
GEOS 226	Earth Materials	4			Humanities Elective	3	
		<u>16</u>				<u>17</u>	

3rd and 4th Years at Montana Tech

Junior				Senior			
ENGR 2060	Engineering Dynamics	3		ENGR 3340	Thermodynamics I	3	
ENGR 2530	Electric Circuits	3		ENGR 4040	Professional Engineering	1	
ENGR 3260	Fluid Mechanics	3			Technical Elective	3	
ENGR 3350	Mechanics of Materials	3			Mining/Enviro. Elec.	3	
ENGR 3360	Mechanics of Materials Lab	1		MIN 3050	Unit Mining Operations	4	
MATH 2236	Differential Equations	3		MIN 3100	Comp. Aided Mine Des.	2	
METE 2320	Proc. of Particulate Systems	2		MIN 4010	Mine Design - Surface	3	
METE 2340	Particulate Processing Lab	1		MIN 4080	Mine Valuation	3	
MIN 1050	Introduction to Mining	2		MIN 4560	Mine Ventilation	3	
MIN 1110	Miner Safety Training	2		MIN 4580	Mine Management	3	
MIN 1520	Mapping, Surf. Mod. & Volum.	3		MIN 4700 W	Mine Design Project	3	
MIN 2100	Plane Surveying	3		MEC 3630	Engr. Econ. & Fin. Mgmt.	3	
MIN 2150	Mining Methods	3		MED 4000	Econ. of Minerals Ind.	3	
MIN 4060	Mine Surveying	1					
MIN 4670	Geomechanics	3					
		<u>36</u>				<u>37</u>	

Bachelor of Science with a Major in Petroleum Engineering

Freshman		Fall Semester		Sophomore		Fall Semester	
MATH 152	Calculus I	4		MATH 251	Calculus III	4	
PHYS 211	Fundamentals of Physics	4		CHEM 161	General Chemistry	5	
PHYS 213	Physics lab I	1		COMM 111	Intro. to Public Speak.	3	
PHYS 175	Intro. to Engineering	3			Social Sci. Elective	3	
ENEX 101	Composition	3			Humanities Elective	3	
GEOS 100	General Geology	2					
GEOS 101	General Geology Lab	1					
		<u>18</u>				<u>18</u>	

Freshman		Spring Semester		Sophomore		Spring Semester	
MATH 153	Calculus II	4		MATH 341	Probability and Statistics	3	
PHYS 212	Fundamentals of Physics	4		CHEM 162	General Chemistry	5	
PHYS 214	Physics lab II	1		PHYS 295	Engineering Statics	3	
ECON 111	Microeconomics	3		CHEM 162	Comm. Physics	3	
GEOS 226	Mineralogy and Petrology	4			Humanities Elective	3	
		<u>16</u>				<u>17</u>	

3rd and 4th Years at Montana Tech

Junior		Senior			
ENGR 3260	Fluid Mechanics	3	PET	Elective	6
ENGR 3340	Thermodynamics I	3	PET 3020	Petro. Prod. Engr.	3
ENGR 3350	Mechanics of Materials	3	PET 3070	Petro. Prod. Lab	1
ENGR 3360	Mechanics of Materials Lab	1	PET 3480	Petro. Well Logging	3
GEOE 4570	Subsurface Meth. in Pet. Geol.	3	PET 4100	Reservoir Simulation	3
MATH 2236	Differential Equations	3	PET 4520	Natural Gas Engr.	3
MEC 3630	Engineering Economy	3	PET 4530	Natural Gas Lab	1
PET 2010	Elements of Petro. Engineering	2	PET 4460	Petro. Project Eval.	3
PET 2050	Petroleum Engineering Lab I	1	PRT 4440	Wat. & Enh. Oil Rec.	3
PET 2020	Petroleum Field Practices	1	PET 4920	Petro. Engr. Pro. Des.	3
PET 2060	Petroleum Engineering Lab II	1		Technical Elective	6
PET 3010	Drilling Engineering	3			
PET 3030	Drilling Fluid Lab	1			
PET 3040	Introduction to Rock Properties	3			
PET 3720	Petro. Fluids & Thermodynamics	3			
PET 4040	Reservoir Engineering	3			
PET 4260	Reservoir Characteristics	2			
		<u>39</u>			<u>35</u>



September 19, 2008

Provost Royce Engstrom
 UJM Provost Office
 UJH 126
 32 Campus Drive MS 3344
 Missoula, MT 59812



Dear Dr. Engstrom,

It is with pleasure that I endorse and support the creation of a 2-2 engineering transfer program at The University of Montana. I have worked with Dr. Maureen McGraw in designing a program that will allow UofM students who complete the U of M program seamless transfer to engineering programs in the School of Mines and Engineering at Montana Tech of The University of Montana.

Dr. McGraw has visited each engineering program at Montana Tech to discuss the 2-2 transfer program and solicit their advice while she was designing the 2+2 transfer program.

Sincerely

A handwritten signature in black ink, which appears to read "H. Peter Knudsen".

H. Peter Knudsen, PhD, PE

Dean
 School of Mines and Engineering

January 7-8, 2009

ITEM 142-1002-R0109

Approval to create a Biochemistry Program and a BS in Biochemistry degree and to change the name of the graduate program in “Biomolecular Structure and Dynamics” to “Biochemistry and Biophysics”

THAT:

In accordance with Montana University System Policy, the Board of Regents of Higher Education authorizes The University of Montana to create a joint Biochemistry Program between the Department of Chemistry & Biochemistry and the Division of Biological Sciences. The program will administer all aspects of the discipline of biochemistry at The University of Montana, including the new BS in Biochemistry and the graduate program in Biochemistry and Biophysics.

EXPLANATION:

The Biochemistry Program will integrate the efforts and expertise of faculty in two College of Arts and Science departments, the Department of Chemistry & Biochemistry and Integrative Microbiology & Biochemistry from the Division of Biological Sciences, to create a focal point for the discipline of biochemistry at The University of Montana. At present, biochemistry offerings in the College of Arts and Science are provided through three separate units, the Department of Chemistry & Biochemistry, the Division of Biological Sciences and the graduate program in Biomolecular Structure and Dynamics creating a diffuse presence for biochemistry at The University of Montana. The Biochemistry Program will bring together these programs under a single administrative umbrella, it will create and develop the first BS in Biochemistry degree in the state of Montana, and it will administer the Biochemistry & Biophysics graduate program. The expected outcomes include an enhanced ability to compete nationally for students in the vibrant and growing field of biochemistry, stronger and more creative pedagogy in biochemistry at both the undergraduate and graduate level, enhanced research activity and thus increased grant volume and the ability to attract and retain top-quality faculty in this discipline.

ATTACHMENTS:Appendices [A](#), [B](#), [C](#), [D](#)

MONTANA BOARD OF REGENTS

LEVEL II REQUEST FORM

Item No.:	142-1002-R0109	Date of Meeting:	January 7-8, 2009
Institution:	The University of Montana - Missoula		
Program Title:	Biochemistry Program and BS in Biochemistry		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

This is a request to create a Biochemistry Program that will consolidate the discipline of biochemistry at The University of Montana under a single administrative umbrella. It will include faculty from two College of Arts and Science departments, the Department of Chemistry & Biochemistry and Integrative Microbiology & Biochemistry from the Division of Biological Sciences. This is also a request to create a new BS in Biochemistry degree and to change the name of the existing graduate program in "Biomolecular Structure and Dynamics" to "Biochemistry and Biophysics". The Biochemistry Program will administer both the undergraduate and graduate degree programs.

Narrative: Biochemistry Program and BS in Biochemistry**1. Overview**

The *Biochemistry Program* will administer the new *BS in Biochemistry* proposed here and will assimilate and administer the existing graduate program in “Biomolecular Structure and Dynamics” renaming this program “Biochemistry and Biophysics”. The program will integrate the efforts and expertise of faculty in two College of Arts and Science departments, the Department of Chemistry & Biochemistry and Integrative Microbiology & Biochemistry from the Division of Biological Sciences (DBS), to create a focal point for the discipline of biochemistry on The University of Montana – Missoula (UM – Missoula) campus. At present, biochemistry offerings in the College of Arts and Science are provided through three separate units, the Department of Chemistry & Biochemistry, DBS and the program in Biomolecular Structure and Dynamics (BSD) creating a diffuse presence for biochemistry on campus. The fact that the Biochemistry link on the Academic Index page of The University of Montana web site leads to a non-existent web page is symptomatic of this situation. By bringing together biochemistry faculty from these disparate units within the College of Arts and Science, the program will be able to develop and support pedagogical programs in biochemistry at the undergraduate and graduate level while promoting the research activities of faculty in the program in association with the Center for Biomolecular Structure and Dynamics (CBSD). The outcomes of creating this program will include an enhanced ability to compete nationally for undergraduate and graduate students in this vibrant and growing field, stronger and more creative pedagogy at both the undergraduate and graduate level, enhanced research activity and thus increased grant volume and the ability to attract and retain top-quality faculty in this discipline.

2. Need

Biochemistry is a core discipline. According to data compiled by the National Center for Education Statistics (NCES), a *BS in Biochemistry* is offered at 398 of the nation’s colleges and universities compared to 1114 institutions that offer a *BS in Chemistry*. Between 2002 and 2006, there has been a 50% increase in *BS in Biochemistry* degrees granted at US universities (see Appendix A). National data indicate that institutions offering a *BS in Biochemistry* on average graduate 12 students with this degree per year compared to an institutional average of 9 students per year for the *BS in Chemistry*. Regional data (Appendix A) for schools offering both a *BS in Chemistry* and a *BS in Biochemistry* (Idaho, Washington, Oregon, Colorado and Utah), show that these schools graduate 13 students with a *BS in Chemistry* and 20 students with a *BS in Biochemistry* annually for every 10,000 students enrolled. In the state of Montana, where only the *BS in Chemistry* is offered at colleges and universities, 11 students graduate with this degree for every 10,000 students enrolled (Appendix A). Thus, rather than shifting existing students from Chemistry to Biochemistry, the availability of a separate major in biochemistry will bring in new students. Given the enrollment at UM – Missoula, this new program will likely graduate 12 (national average) to 23 (regional average) students with a *BS in Biochemistry* per year (or about 45 to 90 majors across four years). Biochemistry is becoming a more common prerequisite for Medical School. As of 2007, 10% of US Medical Schools require biochemistry coursework and an additional 50% encourage it. At UM – Missoula, biochemistry coursework is strongly recommended to pre-medical students and 80% of UM – Missoula students who apply to medical school are accepted. In summary, the proposed major and program would bring new students to UM – Missoula and produce graduates with highly marketable technical skills. There is clear evidence for growth in student interest in the *BS in Biochemistry*. Thus, the time is ripe for the proposed *Biochemistry Program* and *BS in Biochemistry*.

3. Institutional and System Fit

The *BS in Chemistry* offered through the Department of Chemistry & Biochemistry currently has two biochemical options, Biochemistry (American Chemical Society Certified) and Biological Chemistry. These options will be discontinued with the implementation of the *BS in Biochemistry*. Data published in the Committee for Professional Training newsletter of the American Chemical Society (ACS) in summer 2005 (Vol. 4 issue 3, available on the ACS web site: <http://www.acs.org>) indicate that approximately one-third of students pursuing a *BS in Chemistry* select an option in Biochemistry (data from the period 2001

to 2004). Thus, the shift in *BS in Chemistry* students to the new *BS in Biochemistry*, while significant, is not expected to be drastic and should be more than compensated by the new cohort of students the *BS in Biochemistry* will attract to UM – Missoula (see Section 2). The proposed *BS in Biochemistry* is compared in detail to the existing options in the *BS in Chemistry* in Section 4. The Biological Chemistry option with a few minor changes will become the Health Professions option within the proposed *BS in Biochemistry*.

The *Biomolecular Structure and Dynamics Program* is a free-floating degree program in the College of Arts and Science with no specific ties to any departmental unit. It offers M.S. and Ph.D. degrees. The program is affiliated with the CBSD. Bringing it under the auspices of the *Biochemistry Program* and linking it directly to undergraduate offerings in the College of Arts and Science are critical steps in nurturing the growth of this graduate program. Renaming the degree offering *Biochemistry and Biophysics* will confer greater generality on this graduate degree allowing us to attract a larger cohort of students. Thus, the effect on this existing program can only be positive.

UM – Missoula has eight faculty members (Bowler, Briknarova, Ross and Sugden in the Department of Chemistry & Biochemistry and Lodmell, McGuirl, Samuels and Sprang in DBS) with core expertise in biochemistry. Thus, the faculty is in place to provide the proposed *BS in Biochemistry*. Many of these faculty members have been hired as part of UM – Missoula's recent efforts to expand research in the Life Sciences. Thus, the proposed program dovetails nicely with this strategic goal of the university. Six public institutions in the state of Montana offer a *BS in Chemistry*, with an option in Biochemistry within the Chemistry degree available at several of these institutions. The proposed *BS in Biochemistry* would be the first to be offered in the Montana University System. Regional data indicate that a stand-alone *BS in Biochemistry* will attract a new cohort of students.

4. Program Details

The main goal of the *Biochemistry Program* is to bring all aspects of biochemistry curricula together under a single administrative umbrella. To achieve a clear presence for biochemistry at UM – Missoula, current biochemical options within the *BS in Chemistry* will be discontinued or offered as options within the new *BS in Biochemistry*. The program will coordinate undergraduate and graduate degree programs in biochemistry, provide service courses for related disciplines and organize faculty efforts to achieve these goals. These program goals are discussed individually below.

Undergraduate Programs

Background. Currently, the critical courses needed for a *BS in Biochemistry* (BIOC 481, 482 and 486) are taught in DBS, yet, biochemistry degrees are offered as options of the *BS in Chemistry*. This situation leads to a diffuse presence for biochemistry as a discipline at UM – Missoula. Creating a *Biochemistry Program* would provide a clear presence for biochemistry as an undergraduate course of study and would ensure that a group of faculty from Chemistry & Biochemistry and DBS work together to provide a high quality biochemistry curriculum.

The program will offer a new *BS in Biochemistry* that is targeted at students who wish to pursue a career as a biochemist. The major will have the requisite rigor to prepare students for graduate studies. Biochemistry is also an appropriate major for students who plan to work in fields related to biochemistry, thus we will offer a Health Professions option. Both the *BS in Biochemistry* and the Health Professions option meet the standard for ACS certification and thus are suitable replacements for the Biochemistry (ACS certified) option in the current *BS in Chemistry*. Both courses of study are described below.

BS in Biochemistry. The proposed *BS in Biochemistry* (Appendix B) will be the centerpiece of the *Biochemistry Program*. This major provides a rigorous grounding in biology (11 semester credits), chemistry (34 semester credits) and biochemistry (14 semester credits). The major requires a firm foundation in cognate disciplines requiring Calculus I/II and Fundamentals of Physics with Calculus I/II. Computer science, including a course in the burgeoning discipline of bioinformatics, is also required. Capstone courses in biochemistry are in the junior year allowing students to pursue specialized electives and independent research in the senior year.

The proposed major differs strongly from existing biochemical options in the *BS in Chemistry*. Much more biology is required than for the Biochemistry (ACS certified) option. In the Biological Chemistry option, application-oriented courses are required in the cognate disciplines of Math and Physics, there is no computer science and the focus of required upper division biology courses is different.

A common issue with biochemistry majors is that the foundational courses are part of other majors (Biology, Chemistry, etc.). Thus, a sense of community does not readily develop among biochemistry majors early on in college and the opportunity to interact with faculty in their chosen discipline is limited. Hence, an important aspect of developing this new major will be the creation of a freshman level course BIOC 110/111; Biochemistry of Life, lecture/laboratory which will provide a biochemist's approach to understanding the basics of biology. This course will be offered in the spring semester so that students have CHEM 161N as background and CHEM 162N as a co-requisite. This course will have sufficient overlap with BIOL 110N, so that students who decide to major in biology would be able to count this course in lieu of BIOL 110N (pending approval by the DBS curriculum committee). A new course proposal for BIOC 110/111 was submitted and approved. We expect that this first year course will build relationships among students in the major and between these first year students and faculty, and thus will assist significantly in student retention.

We will continue to reinforce faculty-student interactions in this major with a second year seminar course, BIOC 210; Introductory Biochemistry Seminar. This 1 credit course will meet once a week during the spring semester. The course will alternate week to week between a discussion of a paper from the biochemical literature and presentations by *Biochemistry Program* faculty on their research. Our goal is to introduce the students to the faculty and the excitement of research in biochemistry. Students will begin to see that biochemistry is not just a set of immutable facts but a discipline that is alive with unknowns, questions to be asked and answers to be found. Introducing faculty and their research will start our majors thinking about the opportunities available for research as part of their undergraduate studies. A new course proposal for BIOC 210 has been submitted and approved.

Research in the Life Sciences increasingly requires quantitative approaches and the ability to be conversant across multiple scientific disciplines. After a foundation in basic chemistry and biology during the first and second years, the upper level courses in the major are designed to prepare students to practice the quantitative and multidisciplinary field that is modern biochemistry. The rigorous analytical methods taught in CHEM 341-342; Quantitative Analysis and Instrumental Methods will provide the foundation needed in quantitative methods. CHEM 370; Applied Physical Chemistry is essential to provide the basic understanding of spectroscopy, kinetics and thermodynamics needed to work on complex biochemical problems. Metal ions are important players in the function of many biomolecules. CHEM 452; Physical Inorganic Chemistry provides the foundation in metal chemistry necessary to grasp how metals function in living organisms. An understanding of how individual biochemical processes integrate in a living organism is also essential and will be provided by BIOL 464; Advanced Cellular Biology. Finally, the ability to access and analyze information in large databases is an essential skill for the modern biochemist. Thus, our curriculum requires CS 458; Bioinformatics.

Health Professions option. Many students at UM – Missoula will pursue careers in the health professions. Biochemistry is a very appropriate major for this cohort of students. These students do not need as quantitative an approach as offered in the Biochemistry major. They also will benefit from different emphases in upper level courses. Thus, in the cognate disciplines, MATH 150/158 is required instead of MATH 152/153 and PHYS 121N/122N is required instead of PHYS 221N/222N. For students headed to the health professions, basic microbiology is essential. Thus, BIOL 300 replaces BIOL 464 as a required course. No computer science is required, which provides more flexibility for electives in biology and chemistry tailored to a student's specific career goals. The difference between this option and the existing Biological Chemistry option within the *BS in Chemistry* is the requirement that students take BIOC 110/111 and BIOC 210. A full list of requirements is provided in Appendix B.

Service Courses. The primary biochemistry service course is BIOC 380, Fundamentals of Biochemistry. The audience for this course includes students in the School of Pharmacy and majors in DBS. This

course is often taught by adjuncts. The *Biochemistry Program* would provide a mechanism for rotating tenure line faculty through this course. The enrollment in this course averages 95 students and it is currently taught using four 50 minute lectures per week. In the first year of the program, we will change the format to three 50 minute lectures per week with one 50 minute 20 student discussion session per week. These discussion sections will be led by teaching assistants (TA). This approach will create a more interactive learning environment in this course. We are piloting this format during the 2008/2009 academic year with a single large discussion section, since TA support is unavailable. We are using the discussion section for more in depth coverage of clinical topics that will be of interest to these students (see Appendix C for the fall 2008 syllabus for BIOC 380). The additional TA support (see Section 5, Resources) requested in this proposal will allow for more interactive 20-student recitations.

Longer term curricular plans. By uniting biochemistry faculty from Chemistry & Biochemistry and DBS, the *Biochemistry Program* will bring a beneficial focus on biochemistry curricula, providing for a vibrant and responsive curriculum that better serves the needs of UM-Missoula students pursuing this discipline.

As a faculty, we are motivated to introduce biochemical examples into junior/senior level chemistry courses in this curriculum, so that majors come to understand the multidisciplinary nature of biochemistry. Courses that are well-suited to this are CHEM 370; Applied Physical Chemistry, CHEM 341; Quantitative Analysis & Instrumental Methods and CHEM 452, Physical Inorganic Chemistry. The faculty currently assigned to these courses are biochemists and thus well-suited to the task. This goal will be a subject of on-going discussions among the biochemistry faculty in the *Biochemistry Program*.

Biochemistry is a laboratory-based discipline. Thus, an important focus of the faculty will be adding laboratory components to BIOC 481 and 482. These labs will be technique-oriented and will provide majors with the foundations for the more research-oriented BIOC 486, Biochemistry Laboratory course. A laboratory component to BIOC 481/482 will also be an important enhancement to the educational experience of Biology majors pursuing the Cellular and Molecular Biology option. We believe it would be equally important to provide an optional laboratory component for the non-majors course BIOC 380. This laboratory course would be developed with input from the School of Pharmacy and the Medical Technology, Microbiology and Biology with Option in Ecology and Organismal Biology degree programs within DBS. These laboratory courses would be offered as resources [space and teaching assistants] become available.

Graduate Program.

The Center for Biomolecular Structure and Dynamics (CBSD) focuses on structure-function relationships of biological molecules using the tools of biochemistry and biophysics. The related graduate program in *Biomolecular Structure and Dynamics (BSD)*, the requirements for this graduate program are available at <http://www.cas.umt.edu/biomolecular/overview.htm>, one of several graduate programs associated with the CBSD, was created as a cross-disciplinary graduate program housed within the College of Arts and Sciences. The affiliation of the *BSD* graduate program with the CBSD provides essential synergies for graduate education in *BSD*. In particular, the CBSD sponsors a weekly seminar series that is a required component of the graduate program (BIOC 595-1) and it supports multi-user research facilities. Both are essential elements for a research-intensive graduate degree.

BSD is essentially a graduate program in biochemistry and biophysics. To date, the students enrolled in the *BSD* program have selected mentors from the Integrated Microbiology & Biochemistry subdivision of DBS or from the Department of Chemistry & Biochemistry. Students pursuing this degree have also selected advisors from Rocky Mountain Laboratories in conjunction with the UM Graduate Partnership Program. Within the College of Arts and Sciences, faculty members who sponsor *BSD* graduate students also can take students from the graduate programs of their home departments (Department of Chemistry & Biochemistry which offers a *Ph.D. in Chemistry* and the Integrated Microbiology and Biochemistry subdivision of DBS which offers a *Ph.D. in Integrated Microbiology and Biochemistry*). Thus, some cross-over between these graduate degree programs is unavoidable.

Interdisciplinary graduate training in the areas of biochemistry and biophysics at UM – Missoula is robust, as measured by publications per graduate student, post-doctoral success, success at acquiring grants to

support research and other relevant metrics. However, the *BSD*, *Chemistry*, and *Integrated Microbiology and Biochemistry* Ph.D. programs have not been as successful in attracting new students interested in and with the background appropriate for biochemistry. The Integrated Microbiology and Biochemistry graduate program attracts students with more biological interests and background. The *Ph.D. in Chemistry* offered by the Department of Chemistry & Biochemistry attracts students interested in the traditional subdivisions of chemistry (analytical/environmental, organic, physical and inorganic). Likewise, growth in the *BSD* graduate program has been slow. The current name, *Biomolecular Structure and Dynamics*, is too specific. Students looking for graduate programs in biochemistry and biophysics google “biochemistry” or “biophysics” not “biomolecular structure and dynamics”. The availability of only one TA position to recruit new graduate students has also limited growth. Currently, 4 graduate students are enrolled in the program, two of whom are at the Rocky Mountain Laboratory as part of the Graduate Partnership Program.

We propose three important changes for the graduate program. First, creation of a separate *Biochemistry Program* will create a focal point for this discipline. Second, bringing *BSD* under the purview of the *Biochemistry Program* will help to anchor and nurture growth of this graduate program. Through the *Biochemistry Program*, the *BSD* graduate program will have clear ties to two existing academic departments, Chemistry & Biochemistry and DBS. Finally, renaming the *BSD* graduate degree to the more generic *Biochemistry and Biophysics* should increase visibility to prospective students searching for graduate programs in this field, thus aiding in recruitment of top-quality graduate students.

Other elements are essential to the growth of this program. Advertising at a national level is essential to increase the visibility of the graduate program. A three-fold brochure, co-sponsored by the CBSD (Appendix D), went out in fall, 2007, to 600 undergraduate programs around the country as an initial step in this direction. We plan a more targeted approach this year. We will send this brochure directly to all students who take either the chemistry or the biochemistry GRE exam. The ability to grow this graduate program also depends on having adequate Teaching Assistantships (TA) to bring in graduate students. Combining both graduate and undergraduate programs under the auspices of a *Biochemistry Program* will provide a natural home for these TA positions. At the outset, the *Biochemistry Program* will need 2 additional TA positions (beyond the 1 current *BSD* TA) to support the undergraduate curriculum of the *Biochemistry Program*. As the *BS in Biochemistry* grows and biochemistry courses are enhanced with laboratories over the next 3 to 5 years, we anticipate the need for about 2 more TA positions that will also support graduate recruiting. The *Biochemistry Program* would also develop guidelines for the distribution and use of TA positions with the goal of maximizing the growth of the graduate program.

Faculty and Administration.

At the outset, we will define Program Faculty as faculty members who have worked to develop the curriculum for the *Biochemistry Program* and those who will be responsible for the majority of the teaching/advising within this program. As this is a College of Arts and Science program, initially all faculty in the program would have full time tenure-lines either in Chemistry & Biochemistry or DBS and would be expected to contribute to the teaching needs of the program and their home departments. In particular, Program Faculty will be expected to regularly teach biochemistry (BIOC) courses. We do not exclude the possibility of Program Faculty being from outside DBS or Chemistry & Biochemistry if they make a commitment to teach and advise in the program. We note at the graduate level, that graduate students will benefit from our affiliation with the CBSD, allowing them to select from a wider range of possible mentors who are members of the CBSD (for the list of 23 faculty affiliated with the CBSD see <http://www.cas.umt.edu/biomolecular/faculty.htm>). Additional faculty in the program would be justified based on the teaching needs of the program and the home departments. Our feeling is that appointments of junior faculty should be 100% in one department so that the requirements for tenure and promotion are unambiguously defined. The role of the *Biochemistry Program* in tenure and promotion decisions would be advisory, only. Such decisions would be exclusively the domain of the home department.

Our administrative structure is based on that used by the Wildlife Biology Program at UM – Missoula. We project 45 to 90 undergraduate majors across 4 years and the graduate program growing to a steady state of ~10 students, initially. Thus, the program will require substantial

administrative effort on the part of a Program Director. The Program Director will serve for a renewable 3-year term. Bruce Bowler (Professor of Chemistry & Biochemistry) has agreed to be director for the first 3-year term. The responsibilities of the Program Director will be as follows:

- Coordinate with the Chair of Chemistry & Biochemistry, the Associate Dean of DBS, and the Director of the CBSD with regard to mutual needs and goals.
- Administer all biochemistry (BIOC) courses and assign faculty to teach these courses, coordinating assignments with the Chair of Chemistry & Biochemistry and the Associate Dean of DBS.
- Represent the needs of the *Biochemistry Program* to the Dean of the College of Arts and Science and other administrators.
- Work with the faculty in the *Biochemistry Program* to develop and maintain the highest quality biochemistry curricula at all levels.
- Publicize the program to grow the number of students at all levels.
- Ensure that effective mechanisms for advising of students at both the graduate and undergraduate level are developed and maintained.
- Ensure that the program lends expertise to the mentoring of junior *Biochemistry Program* faculty in collaboration with the home departments.

We note that current university policy is that credit for teaching flows to the tenure home of each faculty member as does credit for graduate students. Thus, the efforts of faculty in the program will be credited to their tenure-home. With regard to credit for majors, no formal procedures are in place. Credit for majors in the Wildlife Biology Program (joint between the School of Forestry and DBS in the College of Arts and Science) goes to the School of Forestry. We believe that a formula that splits credit for majors between Chemistry & Biochemistry and DBS is appropriate in this case. A formula agreeable to Chemistry & Biochemistry and DBS will be developed through consultation between the Chair of Chemistry & Biochemistry, the Associate Dean of DBS and the Dean of the College of Arts and Science. Since biochemistry currently exists as an option within the *BS in Chemistry*, splitting credit 2/3 to Chemistry & Biochemistry and 1/3 to DBS might be reasonable. Other formulas are certainly possible.

Implementation time line.

We will be ready to implement this proposal during the first year following Board of Regents approval of the *Biochemistry Program* and the *BS in Biochemistry*. Thus, we will pursue course development for BIOC 110/111 and BIOC 210 during the 2008-2009 academic year while this proposal is moving through approvals. The pilot run of BIOC 380 with a 3 lecture/1 recitation per week format during the 2008-2009 academic year will allow for straightforward implementation of this format with teaching assistants in the first year of the program. The preparation process will also require recruiting of graduate students to fill the TA positions necessary to get the program off the ground. We have already prepared and printed a three-fold advertising brochure for the CBSD and the existing graduate program which should facilitate this process (Appendix D). We also will begin web site preparations so that information about the program is ready to go up on the UM – Missoula web site upon approval.

BIOC 110/111 and BIOC 210 are both spring semester courses. This will allow us to advertise these courses in CHEM 161N and in sophomore level BIOL/CHEM courses during the first year following approval of the *BS in Biochemistry* so that students interested in pursuing a *BS in Biochemistry* will be informed about the program and these courses.

5. Resources

Adequate faculty in Chemistry & Biochemistry and DBS are available to support this program at the outset. We will share existing support staff resources with the home units initially. Thus, start-up needs are modest:

- Two additional TA positions at start of program beyond the existing BSD TA position are requested to cover discussion and laboratory sections and grading needs of biochemistry courses (BIOC 110/111; BIOC 380; BIOC 481; BIOC 482; BIOC 486).
- Administrative needs:
 - Partial teaching release for Program Director.
 - Stipend for the Program Director at the level of a department chair.
- Operating budget to cover administrative operating costs such as office supplies, photocopying, web site maintenance, and postage for student recruiting letters, etc.

6. Assessment

We will track enrollment in BIOC 110/111 and BIOC 210 as initial indicators of the growth in the major. We will also develop a supplemental evaluation form for students in these courses to seek feedback on these courses and on other aspects of student's experiences as biochemistry majors. To assess the quality of the program, we will administer the American Chemical Society standardized Biochemistry exam to all students in BIOC 486 at the end of the junior year. The first *BS in Biochemistry* majors should graduate 4 to 5 years after the beginning of the program. Besides tracking the number of graduates, the Program Director will conduct exit interviews with graduating seniors to obtain feedback on their experiences as biochemistry majors, and to track their immediate and long term career plans as another indicator of the success of the program. We will also track admissions data on applicants and matriculating students indicating biochemistry as their preferred major. We will similarly monitor which choices of "preferred major" are most likely to yield graduates with a *BS in Biochemistry* to better understand the audience for this major. This information will assist us in recruiting efforts for the *BS in Biochemistry*.

Indications of success will include a growth to an enrollment of 20 students in BIOC 110/111 over the first three years of the program and to 15 students in BIOC 210 over the same period. Following this initial period, we would want to see growth to 40 students in BIOC 110/111 and 25 students in BIOC 210 in the subsequent 3 to 5 years. These numbers would be indicative of a steady state of 20 majors per year, in line with regional trends. We expect a 4-5 year lag period in the growth of completed *BS in Biochemistry* degrees assuming that most biochemistry majors start at UM – Missoula in the first year of the program. Thus, growth in completed *BS in Biochemistry* degrees to 20 graduates per year during years 5 to 8 would be considered a success.

The graduate program should reach a steady-state over the course of five years. With three TA positions, we can bring in 3 new students per year. Assuming a small amount of attrition, we should be at a steady-state of 10 students in the program within 5 years, which we would consider success.

7. Process Leading to Submission

Discussions among a group of biochemists (Steve Lodmell, Michele McGuirl and Steve Sprang from DBS and Bruce Bowler, Sandy Ross, Kent Sugden and Klara Briknarova from Chemistry & Biochemistry) convened by Bruce Bowler began during the fall semester, 2007 to design a *BS in Biochemistry* and to consider how it might be administered. Early in this process, we consulted with Dan Pletscher, Director of the Wildlife Biology Program, for insight into building a program which bridges between existing units. The Chair of Chemistry & Biochemistry, Mark Cracolice, the Associate Dean of DBS, Charlie Janson, and the Dean of the College of Arts and Science, Jerry Fetz, were kept apprised of these discussions and provided with early drafts of our proposal for comment. Informal input was also sought from other faculty members in Chemistry & Biochemistry and DBS. Feedback on the proposal was received at faculty meetings in Chemistry & Biochemistry and DBS in late 2007 and early 2008. Our plans to modify BIOC 380, Fundamentals of Biochemistry were discussed with Lori Morin in the School of Pharmacy and Mike Minnick from the Medical Technology program in DBS in late April 2008, since these programs provide

many of the students in this service course. On May 12, 2008, Bruce Bowler met with Provost Royce Engstrom, Associate-provost Arlene Walker-Andrews, Associate Dean of DBS Charlie Janson and Chair of Chemistry & Biochemistry, Mark Cracolice to discuss implementation of and resource needs for this program. Provost Engstrom gave the go ahead to proceed with proposal preparation for the program in consultation with Associate-provost Arlene Walker-Andrews. Provost Engstrom indicated that he would work to find resources for 2 additional TA positions and a stipend for the Program Director similar to that of a department chair. The *Biochemistry Program* proposal committee met over the summer of 2008 to finalize this proposal. The proposal was distributed to faculty in Chemistry & Biochemistry and in DBS and to Deans Jerry Fetz and Bonnie Allen for consideration at the beginning of the fall semester. Input was sought from Lori Morin and Rich Bridges in the School of Pharmacy at the same time. Approvals for this proposal from departments and deans were obtained at the beginning of the fall semester 2008 from & Biochemistry and DBS in advance of submission to the Provost's office and ASCRC in late September, 2008.

This proposal was reviewed and approved by the affected departments as follows:

Department Name: **Chemistry** Date: September 19, 2008

Department Name: **Division of Biological Sciences** Date: September 10, 2008

In addition the deans of the following Schools/Colleges reviewed and approved the proposal:

Dean of: **College of Arts and Sciences** Date: September 16, 2008

Dean of: **Libraries** Date: October 1, 2008

The proposal was reviewed and approved by the Faculty Senate at the University of Montana Date: November 13, 2008

[No outside consultants were employed for the development of this proposal.]

Appendix A
National and Regional Data on Chemistry and Biochemistry Majors

All data were obtained from the website of the National Center for Educational Statistics (NCES, <http://nces.ed.gov/>) and its allied website, College Navigator (<http://nces.ed.gov/collegenavigator/>) unless otherwise indicated.

Graph 1. Nationwide trends in graduates in chemistry and biochemistry from 1998 to 2006.

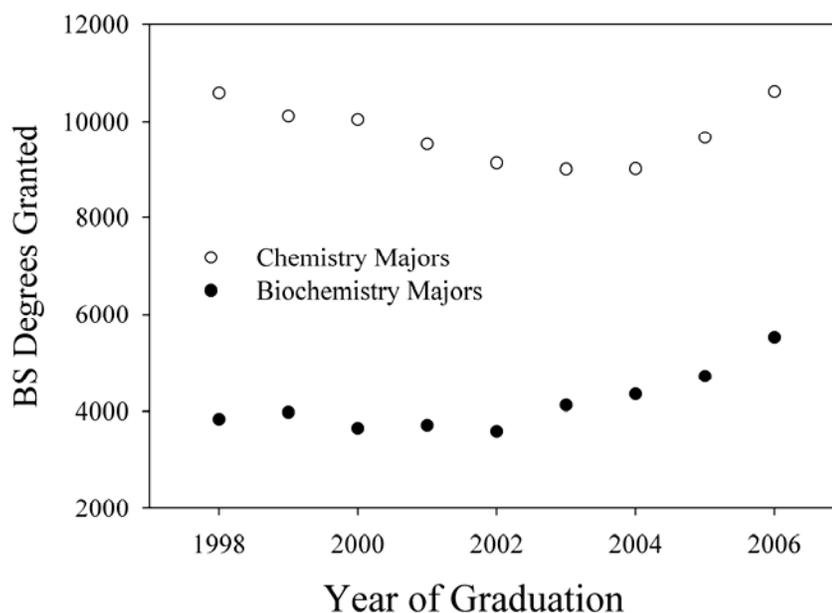


Table 1: Four year colleges/universities offering a BS in Chemistry or a BS in Biochemistry in the Northwest and Rocky Mountain regions.

State	Chemistry	Biochemistry
Montana	8	0
Idaho	7	1
Wyoming	1	0
North Dakota	7	1
South Dakota	8	1
Washington	14	8
Utah	7	2
Colorado	15	6
Oregon	14	6

Table 2: 2006-2007 graduates by major for schools in the Northwest and Rocky Mountain region offering both a BS in Chemistry and a BS in Biochemistry.

State	School	Chemistry	Biochemistry	Undergraduate Student Population	Chemistry Graduates per 10000 students enrolled	Biochemistry Graduates per 10000 students enrolled
Idaho						
	Idaho State University	15	5	11024	13.6	4.5
	State Totals	15	5	11024	13.6	4.5
Washington						
	Gonzaga University	1	8	4385	2.3	18.2
	Seattle Pacific University	4	8	3038	13.2	26.3
	Seattle University	5	7	4253	11.8	16.5
	University of Puget Sound	7	3	2537	27.6	11.8
	University of Washington - Seattle	101	164	28570	35.4	57.4
	Walla Walla University	0	4	1611	0.0	24.8
	Washington State University	12	25	20282	5.9	12.3
	Western Washington University	27	15	13099	20.6	11.5
	State Totals	157	234	77775	20.2	30.1
Utah						
	Brigham Young University	20	26	30873	6.5	8.4
	Utah State University	12	7	13179	9.1	5.3
	State Totals	32	33	44052	7.3	7.5
Colorado						
	Colorado College	1	18	2053	4.9	87.7
	Colorado State University	22	35	21671	10.2	16.2
	Regis University	5	3	5786	8.6	5.2
	Air Force Academy	5	16	4461	11.2	35.9
	University of Colorado - Boulder	24	77	26348	9.1	29.2
	University of Denver	2	6	5285	3.8	11.4
	State Totals	59	155	65604	9.0	23.6
Oregon						
	Eastern Oregon University	4	5	3032	13.2	16.5
	Lewis and Clark University	7	10	1964	35.6	50.9
	Pacific University	1	1	1453	6.9	6.9
	Portland State University	6	19	18916	3.2	10.0
	Reed College	10	4	1464	68.3	27.3
	University of Oregon	19	12	16674	11.4	7.2
	State Totals	47	51	43503	10.8	11.7
Regional Totals		310	478	241958	12.8	19.8

Table 3: 2006-2007 chemistry graduates at Montana colleges and universities offering a BS in Chemistry

School	Chemistry Graduates	Undergraduate Student Population	Chemistry Graduates per 10000 students enrolled
Carroll College	5	1382	36.2
Montana State University - Bozeman ¹	14.8	10491	14.1
Montana State University - Billings	2	3265	6.1
Montana State University - Northern	0	1143	0.0
Montana Tech - Butte ¹	3.2	1796	17.8
Rocky Mountain College	0	847	0.0
University of Montana - Missoula ¹	9	11324	7.9
University of Great Falls	0	639	0.0
State Totals	34	30887	11.0

¹For these schools a five year average ending in 2006-2007 is used incorporating data obtained from the American Chemical Society web site: <http://www.acs.edu>

Appendix B

Bachelor of Science in Biochemistry

CHEM 161N-162N; General Chemistry I&II + Lab	10
CHEM 221-224; Organic Chemistry I&II + Lab	10
-CHEM 264; Organic Majors Lab may be substituted for CHEM 224	
CHEM 341-342; Quantitative Analysis and Instrumental Methods	8
CHEM 370; Applied Physical Chemistry	3
-CHEM 371; Physical Chemistry I may be substituted for CHEM 370	
CHEM 452; Physical Inorganic Chemistry	3
BIOC 110-111; Biochemistry of Life + Lab	4
BIOC 210; Introductory Biochemistry Seminar	1
BIOC 481-482W; Biochemistry I & II	6
BIOC 486W; Biochemistry Laboratory	3
BIOL 221; Cellular and Molecular Biology	4
BIOL 223; Genetics and Evolution	4
BIOL 464; Advanced Cellular Biology	3
MATH 152-153; Calculus I&II	8
PHYS 221N-222N; Fundamentals of Physics with calculus I&II + Lab	10
CS 177; Computer Modeling for Science Majors	3
CS 458; Bioinformatics	<u>3</u>
Total:	83

13 credits of electives from BIOL 301, 312, 313, 345, 347, 400, 401, 440, 460, 497¹; BIOC 497¹; BMED 347, 421, 422; CHEM 372, 380, 442, 453, 455, 465, 466, 485, 497,¹ 498¹; MICB 300, 301, 302, 309, 404, 405, 410, 411, 420.

¹No more than 3 credits combined of BIOL 497, CHEM 497, 498 or BIOC 497 may be counted toward the 13 credit elective requirement.

For Group I of the General Education requirements (English Writing Skills), all students must complete ENEX 101, a lower division writing course, an upper division writing course, and need to obtain a score of 3 or better on the WPA exam. The upper division requirement will be satisfied by BIOC 482W (1/3 of requirement) and BIOC 486W (2/3 of requirement). Writing course proposals for BIOC 482W and BIOC 486W will be submitted in spring, 2009, when the new writing course guidelines are finalized.

Group II of the General Education requirement (Mathematics) is fulfilled by MATH 152-153

The Foreign Language/Symbolic Systems requirement (Group III of the General Education Requirement) is fulfilled by MATH 152.

All students must complete 27 credit hours from groups IV to XI of the General Education requirement to graduate (CHEM 161N-162N counts as the 6 credit group XI requirement). One of these courses should be an approved lower division writing course.

Credits to Graduate:

Required courses:	83
Elective courses:	13
General education: ¹	21
ENEX 101:	<u>3</u>
Total:	120

¹Groups IV to X account for 21 credit hours.

Bachelor of Science in Biochemistry:
Health Professions Option

CHEM 161N-162N; General Chemistry I&II + Lab	10
CHEM 221-224; Organic Chemistry I&II + Lab	10
-CHEM 264; Organic Majors Lab may be substituted for CHEM 224	
CHEM 334; Chemistry Literature and Scientific Writing	3
CHEM 341-342; Quantitative Analysis and Instrumental Methods	8
CHEM 370; Applied Physical Chemistry	3
-CHEM 371; Physical Chemistry I may be substituted for CHEM 370	
CHEM 452; Physical Inorganic Chemistry	3
BIOC 110-111; Biochemistry of Life + Lab	4
BIOC 210; Introductory Biochemistry Seminar	1
BIOC 481-482W; Biochemistry I & II	6
BIOL 221; Cellular and Molecular Biology	4
BIOL 223; Genetics and Evolution	4
MICB 300; General Microbiology	3
-MICB 302; Medical Microbiology may be substituted for MICB 300	
MATH 150; Applied Calculus	4
MATH 158; Applied Differential Equations	3
PHYS 121N-122N; Fundamentals of Physics I&II + Lab	<u>10</u>
Total:	76

20 credits of electives from BIOL 301, 312, 313, 345, 347, 400, 401, 440, 460, 497¹; BIOC 486, 497¹; BMED 347, 421, 422; CHEM 372, 380, 442, 453, 455, 465, 466, 485, 497,¹ 498¹; MICB 300, 301, 309, 404, 405, 410, 411, 420.

¹No more that 3 credits combined of BIOL 497, CHEM 497, 498 or BIOC 497 may be counted toward the 20 credit elective requirement.

For Group I of the General Education requirements (English Writing Skills), all students must all students must complete ENEX 101, a lower division writing course, an upper division writing course, and need to obtain a score of 3 or better on the WPA exam. CHEM 334 is the formal requirement to satisfy the upper division requirement in this option. It can also be satisfied by taking the following combinations of required and elective courses: BIOC 482W and BIOC 486W; BIOC 482W, MICB 410 and MICB 411; MICB 404 or MICB 420.

Group II of the General Education requirement (Mathematics) is fulfilled by MATH 150-153

The Foreign Language/Symbolic Systems requirement (Group III of the General Education Requirement) is fulfilled by MATH 152-158.

All students must complete 27 credit hours from groups IV to XI of the General Education requirement to graduate (CHEM 161N-162N counts as the 6 credit group XI requirement). One of these courses should be an approved lower division writing course.

Credits to Graduate:

Required courses: 76
Elective courses: 20

General education: ¹	21
<u>ESEX 101:</u>	<u>3</u>
Total:	120

¹Groups IV to X account for 21 credit hours.

Appendix C

The syllabus of BIOC 380 is provided to show the implementation of a discussion section in place of the Tuesday lecture. The topics of these discussion sections are designed to be closely related to the main lecture, but to provide for in depth coverage of clinical biochemistry that will be of interest to pharmacy students and biology majors. With teaching assistant support we will be able to break the discussion part of the course into 20 student sections that meet in smaller classrooms, permitting a more interactive atmosphere.

BIOC 380 Syllabus

BIOC380--Fundamentals of Biochemistry--Fall 2008

Instructors:

Dr. Stephen Lodmell, CHCB202, stephen.lodmell@umontana.edu

Office hours Mondays, Tuesdays 11-12 (CHCB202)

Dr. Sandy Ross, CP013, sandy.ross@umontana.edu

Office hours Wednesdays 3-4 and Thursdays 3-4 (CP204)

Time & Room: 10:10-11:00am MTWF LA11

Teaching assistant: Travis Danielson (help session hours and location TBA)

Text: Horton et al. Principles of Biochemistry 4th ed.

iClickers will be used in this course

Course Aims

This course aims to provide a fundamental knowledge of biochemistry, including

- understanding the chemical and thermodynamic properties of biomolecules
- knowledge of the four main classes of biomolecules, including their structure, synthesis and function
- understanding the catalytic and regulatory strategies of enzymes
- understanding the production, use and regulation of energy in the cell
- understanding how signal pathways regulate networks of chemical reactions
- understanding how biomolecular building blocks and chemical reaction networks are integrated into systems to form a functional cellular metabolism

Prerequisites: Biochemistry is a subdiscipline of chemistry, so students should have a good working knowledge of inorganic and organic chemistry. The logic of biochemistry is clearest if you understand the underlying chemical principles. It is a good idea to review basic chemical concepts and organic reactions on your own early in the course.

Course Requirements

Students are expected to study the text carefully, and are encouraged to read the text prior to the corresponding lectures. Questions or problem sets will be assigned for each chapter, but they will not be collected or graded. However, similar questions can be expected on quizzes and tests.

During the lectures, questions will be posed to the class that will require an iClicker to answer. Results of the responses are recorded and contribute to the final grade. This technology aids in assessing student comprehension during lectures, and helps to keep students engaged and able to participate in active learning, even in large classroom settings.

Students are also encouraged to participate in class discussions as well as to meet outside of class in study groups. An online forum is also provided for the class to serve as another means for asking questions and discussing course material. Refer to the course ERES page for other course resources.

Lecture and discussion format

The Monday, Wednesday, and Friday lectures will cover material from the text and occasional additional readings that will be posted on ERES. Tuesday lecture periods will include discussion of additional topics related to MWF lectures as well as 15 minutes set aside for quizzes. Material covered in the Tuesday discussion periods will typically be of clinical/medical, or physiological relevance and students are responsible for this material on subsequent quizzes and exams. On three Tuesdays during the semester the entire time will be used for the midterm exams.

Electronic response (iClicker) technology will be used in this course. Students who do not already own an iClicker must purchase one and bring it to each class. The iClickers will be used for the purposes of keeping students engaged in the material during lectures, for assessing student comprehension of recently covered topics, and to assess student attendance in the course.

Grading

There will be weekly quizzes given on Tuesdays. In addition there will be four exams, consisting of three one hour midterm exams (also given on Tuesdays) and one comprehensive final exam. The lowest score out of the three midterm exams will be dropped, but the final exam score will be averaged into the final grade. Correct answers given for iClicker questions will earn one point, incorrect answers will be awarded 0.4 point, and the absence of an answer will be awarded no points. The composite iClicker score will contribute 5% to the final grade. The course grade is determined from the exam and quiz scores and iClicker responses as follows:

2 highest out of 3 midterm exams:	50%
8 highest out of 10 weekly quizzes:	20%
iClicker responses/ participation	5%
Final exam	25%

Final grades will be assigned as follows: 90-100% = A, 80-89% = B; 70-79% = C; 60-69% = D; below 60% = F. Plusses and minuses will be used for grades at the extremes of the letter grade range as follows: A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F.

Missed Quizzes and Exams

The two lowest quiz grades will be dropped (including any missed quizzes), but makeup quizzes will not be given. Students will have the option of dropping the lowest of the three midterm exam scores and should use this flexibility to cover a missed exam. Exceptions will only be made for unusual circumstances and in accordance with the general absence policies and procedures, as described in the UM course catalog.

Notes and ERES

Class notes will be posted on the electronic reserve system (ERES) from the Mansfield Library. To access this, go to the Mansfield Library home page, then follow the link for ERES. You can access the course using either our names or the course number. A password will be required, which will be provided to you in class. Remember that these notes are what we use as an *outline* for class preparation. They are not intended to be used as a substitute for coming to class or for doing the readings.

General Policies

University policies on drops, adds, changes of grade option, or change to audit status will be strictly enforced in this course, as described in the course catalog.

University policies on drops, adds, changes of grade option, or change to audit status will be strictly enforced in this course. These policies are described in the current catalog. Students should specifically note that after the 30th day of the semester, such changes are NOT automatically approved. They may be requested by petition, but the petition MUST be accompanied by documentation of extenuating circumstances. Requests to drop a course or change the grade basis to benefit a student's grade point average will not be approved.

Note:

- A recent change in university policy states that a "P" grade is given in lieu of A, B, or C grade; an "F" grade is given in lieu of a D or F grade.
- After the 15th day of classes, students will not be able to change from a grade to audit status, under any circumstances.

Academic integrity: In working through homework assignments, students are encouraged to work together to solve problems, to share information or resources, and to test each other's understanding of the material. Those are all acceptable forms of collaboration. However, the written work that each student turns in must be his or her own. Only in this way can faculty judge individual understanding of concepts or information. A good rule of thumb for students to follow is to work together up to the point of committing words to paper. At that stage, each student must work independently. A second key guideline is that once a student has written an out-of-class assignment, it must not be shown to another student in the course. Assignments from two or more students that have significant overlap, in the professional judgment of the faculty member, will be regarded as reflecting a violation of the expectation that students turn in independent assignments. Please note that direct copying of sentences from any published source without proper citation is considered plagiarism. THIS INCLUDES THE INTERNET. Be sure to put the information in your own words and be aware that the instructor will check literary and internet resources. Violations will be dealt with according to the Student Conduct Code. *All students must practice academic honesty during and outside of class. Academic misconduct is subject to academic sanction, as described in the Student Conduct Code:* <http://life.umt.edu/VPSA/name/StudentConductCode> .

Registering your iClicker

iClickers will be used for participation points. iClickers should be registered during the first week of class: use your iClicker at least once in class and then complete the form at:

<http://www.iclicker.com/registration/>

1. Enter your First Name and Last Name in the appropriate boxes.
2. Enter your UM student ID.
3. Enter your iClicker remote ID (this is the unique set of numbers and letters located on the bottom of the back of the clicker).
4. Enter the security code that appears on the screen, which will appear as a slightly distorted series of numbers and/or letters. Click the "Enter" button.
5. You will see an on-screen message confirming that registration was successful. Your student ID is now linked to your unique iClicker remote ID. You can use one iClicker for multiple classes and only need to register on the web once.

iClickers should be registered by the second week of class.

Your votes in class will be recorded before you register your iClicker. Your answers to questions and participation points are tied to your name and student ID by registering your iClicker.

Special Accommodations

If you are registered with Disability Student Services and require special accommodations, please contact Dr. Lodmell or Dr. Ross to make arrangements.

Tentative lecture topics schedule

M 8/25 Course introduction, Chapter 1

T 8/26 Discussion topic: (more from Chapter 1)

W 8/27 Chapter 1- Introduction, Chapter 2: Water.

F 8/29 Chapter 2- Water, pH, buffers

M 9/1 Labor Day holiday

T 9/2 Discussion topic: blood gases and electrolytes; Quiz 1

W 9/3 Chapter 3- amino acids

F 9/5 Chapter 3- amino acids, peptide sequencing

M 9/8 Chapter 4- protein structure

T 9/9 Discussion topic: proteins—many structures, many functions and Quiz 2

W 9/10 Chapter 4- protein structure, effectors, conformational changes

F 9/12 Chapter 5- Enzyme properties

M 9/15 Chapter 5- Enzyme kinetics and inhibition

T 9/16 Discussion topic: allostery and cooperativity—MWC and KNF and Quiz 3

W 9/17 Chapter 6- Enzyme mechanisms

F 9/19 Chapter 6- Enzyme mechanisms- serine proteases

M 9/22 Chapter 7- Vitamins and coenzymes. ATP, NAD⁺, FAD, CoA

Tuesday 9/23 Exam Chapters 1-6 (LA11 at normal class time)

W 9/24 Chapter 7- Thiamine, pyridoxal, biotin, lipoic acid

F 9/26 Chapter 8- simple sugars, aldoses and ketoses (Note: **Last day to drop w/o fees**)

M 9/29 Chapter 8- other sugars and sugar polymers

T 9/30 Discussion topic: many sugars, many functions and Quiz 4

W 10/1 Chapter 9- Lipids: fatty acids, triacylglycerols, phospholipids, steroids

F 10/3 Chapter 9- Membranes, transport, and signaling across membranes

M 10/6 Chapter 10- Overview of metabolism

T 10/9 Discussion topic: signals and defects of metabolism and Quiz 5

W 10/8 Chapter 10- Overview of metabolism

F 10/10 Chapter 11- Glycolysis: the reactions

M 10/13 Chapter 11- Glycolysis: regulation and alternative substrates

T 10/14 Discussion topic: regulation of blood glucose and Quiz 6

W 10/15 Chapter 12- Gluconeogenesis: three reactions differ from glycolysis

F 10/17 Chapter 12- Glycogen metabolism

M 10/20 Chapter 13- Citric acid cycle

Tuesday 10/21 Exam Chapters 7-12 (LA11 at normal class time)

W 10/22 Chapter 13- Citric acid cycle

F 10/24 Chapter 13- Citric acid cycle

M 10/27 Chapter 14- Electron transport chain

T 10/28 Discussion topic: diseases of the electron transport and Quiz 7

W 10/29 Chapter 14- Electron transport chain

F 10/31 Chapter 14- ATP synthesis (Note: **Last day to drop without special petition**)

M 11/3 Chapter 16- Lipid metabolism: fatty acid biosynthesis

T 11/4 *Election Day holiday*

W 11/5 Chapter 16- Fatty acid oxidation

F 11/7 Chapter 16- Ketone bodies, diabetes

M 11/10 Chapter 19- Nucleotides

T 11/11 *Veterans Day holiday*

W 11/12 Chapter 19- Nucleic acids: RNA and DNA

F 11/14 Chapter 20- DNA replication

M 11/17 Chapter 20- DNA repair

Tuesday 11/18 Exam Chapters 14, 16, 19, 20 (LA11 at normal class time)

W 11/19 Chapter 20- DNA recombination

F 11/21 Chapter 21- Transcription

M 11/24 Chapter 21- Transcription

T 11/25 Discussion topic: transcriptional regulation gone bad and Quiz 8

W 11/26 Thanksgiving holiday

F 11/28 Thanksgiving holiday

M 12/1 Chapter 22- Protein synthesis

W 12/3 Chapter 22- Protein synthesis

F 12/5 Catch up/ review?

(42 MWF lectures; 15 weeks)

FINAL EXAM: 8:10-10:00am Thursday 12/11/2008 in LA011

Appendix D

**Three-fold brochure for the
Center for Biomolecular Structure and Dynamics
and
Associated BSD Graduate Program**

Ph.D. Program

The doctoral degree associated with the Center for Biomolecular Structure & Dynamics (CBSD) provides rigorous training for those who want to work at the interface of the biological and physical sciences to probe the molecular basis of life.

The foundation of the program is a core curriculum centered on:

- Nucleic Acid & Protein Biochemistry
- Biophysical Methods
- Cellular Biochemistry

Students benefit from the focused and highly personal interdisciplinary atmosphere created by the more than 20 laboratories collaborating across the three academic departments within the Center.

In addition to seminar programs in each of the participating departments, the biweekly CBSD Seminar Program attracts leading biophysicists and structural biologists to share their latest research and insights.



The University of Montana is located in Missoula in the heart of western Montana's Rocky Mountain grandeur at the confluence of three major rivers. It is surrounded by national forests, and is near Glacier and Yellowstone National Parks. It has unparalleled access to outdoor recreation including fishing, kayaking, mountain biking, hiking, cross-country and downhill skiing. Missoula is a cultural hub with a thriving downtown filled with coffeehouses, nightclubs, pubs and restaurants serving everything from steak to sushi.

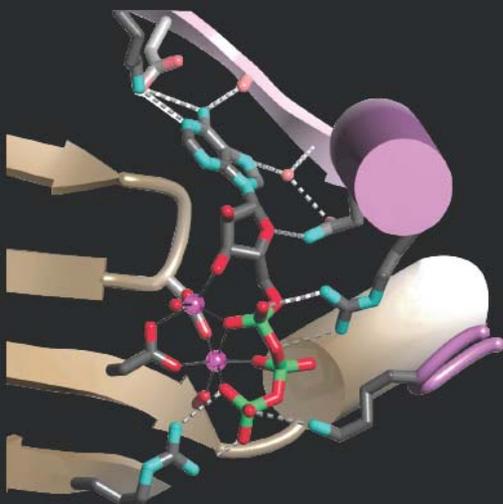
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Center for
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Missoula, MT 59812-1656

The University of Montana

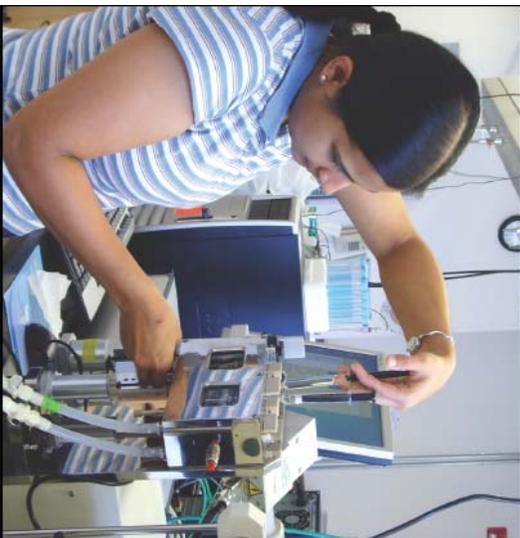
Center for
BIOMOLECULAR
STRUCTURE &
DYNAMICS



These are exciting times in Structural Biology. With the completion of the Human Genome Project and the development of rapid screening Proteomics methods, the scientific community is poised to probe the molecular nature of life at depths we could only imagine a few short years ago. The impact of this new world of research on human health is still to be known.

Here at the University of Montana, we are investing in this new, scientific revolution by developing a Center for Biomolecular Structure & Dynamics to take a leadership role in these dynamic fields of study. Integral to this effort is our unique interdisciplinary Ph.D. program. Come be part of this compelling endeavor.

Stephen Sprang
Director
Center for Biomolecular Structure & Dynamics



The Center

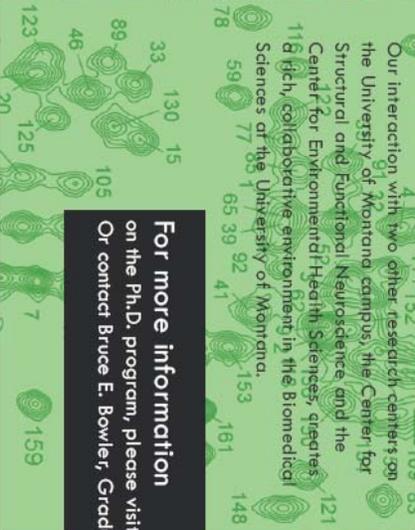
Researchers in the CBSD study a broad array of problems in the Biomedical Sciences including:

- Viral RNA Structure and Dynamics
- Protein Folding and Misfolding
- Signal Transduction
- Biological Electron Transfer
- Protein-Protein and Protein-DNA Interactions
- Role of Metals in Biology
- Neurotransmitter and Vesicular Transport
- Biosynthesis and Metabolic Engineering

The thread connecting these diverse research programs is a desire to probe these biological systems at the molecular level using the tools of modern Structural Biology and Proteomics in our state-of-the-art instrumentation facilities.



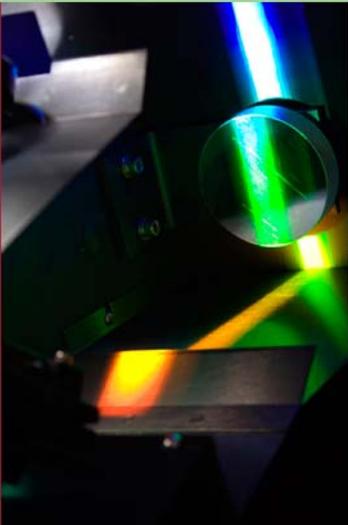
Our interaction with two other research centers on the University of Montana campus, the Center for Structural and Functional Neuroscience and the Center for Environmental Health Sciences, creates a rich, collaborative environment in the Biomedical Sciences at the University of Montana.



Facilities

The CBSD has excellent research facilities:

- **Murdoch DNA Sequencing Facility** for rapid-turnaround sequencing.
- **BioSpectroscopy Core Research Facility** with femto- and picosecond lasers and single-molecule fluorescence capabilities.
- **NMR Core Research Facility** with 400, 500 and 600 MHz multichannel pulsed-field gradient spectrometers and cold probe technologies.
- **Macromolecular X-ray Diffraction Core Research Facility** with Rigaku rotating anode X-ray generator and area detector.
- **Mass Spectrometry Proteomics Core Research Facility** with MALDI-TOF, nano-LC-QTOF, ICP and LCT mass spectrometers.
- **Molecular Computational Core Research Facility** for homology modeling, Monte Carlo calculations, molecular dynamics simulations, docking, etc.



For more information
on the Ph.D. program, please visit our web site: <http://www.cas.umt.edu/biomolecular/>
Or contact Bruce E. Bowler, Graduate Program Chair: bruce.bowler@umontana.edu

M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.: 142-1004-R0109 Date of Meeting: January 7-8, 2009
 Institution: The University of Montana
 Program Title: Minor in Climate Change Studies

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- | | | |
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| <input type="checkbox"/>
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2.
3.
4.
5. | Change names of degrees (e.g. from B.A. to B.F.A.)
Implement a new minor where there is no major;
Establish new degrees and add majors to existing degrees;
Expand/extend approved mission; and
Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit. |
|---|----------------------------|---|

Specify Request:

The University of Montana -- Missoula requests permission to create a new interdisciplinary minor in Climate Change Studies.

Proposal to Create an Undergraduate Minor in Climate Change Studies

1. OVERVIEW: PROGRAM DESCRIPTION

The proposed interdisciplinary undergraduate minor in Climate Change Studies will, if approved, educate students from a wide array of disciplines on the scientific and social issues arising from global climate change. The opportunity to minor in Climate Change Studies complements students' disciplinary focus. It enables students to engage the scientific, societal and political dimensions of global climate change. Further, the focus on solutions and applied learning will help students develop critical thinking and problem solving skills. Participating students, building on their major field of study, will be prepared to enter a broad range of professions and graduate programs where they can meet the emerging challenges and opportunities arising from climate change. The minor takes advantage of existing faculty expertise and diverse courses to provide an innovative interdisciplinary and integrated program. This proposed minor will require 21.0 credits: a 3.0 credit interdisciplinary introductory course, and 6.0 credits in each of the following areas: climate change science, climate change and society, and climate change solutions.

2. DOCUMENTED NEED FOR MINOR

The issue of global climate change is gaining momentum at the local, national and international levels. There is a rapidly increasing body of evidence on the science of the global climate change (IPCC, 2007) indicating a need for social and political action. Global climate change could well be the issue that will define the next generation. Whatever the causes of climate change, it is a fact that the world is moving to respond to the threat of rapid climatic change. Preparing students to meet this challenge will require multi-disciplinary training in the scientific, ethical, political, and economic considerations of global climate change, as well as solutions to the issue that include both mitigation and adaptation.

The nation and world are moving forward to meet the challenge of climate change, and Montana will likewise need to adapt and respond. The state, through the Climate Change Advisory Council, has already identified a number of strategies for how we might respond. This proposed minor will provide undergraduate students with the interdisciplinary perspective and problem-solving skills needed to meet the demands of emerging policies, evaluate proposed strategies, and help facilitate this upcoming transition. This minor would be not only the first Climate Change Studies minor in the state of Montana, but also one of the first *interdisciplinary* climate change minors in the nation.

The proposed minor will address these critical needs and contribute a timely, innovative academic program at the state and national level. For these reasons, it has the potential to a) gain a national reputation; b) be competitive for large national and international grants; c) attract highly motivated students from across Montana and the U.S.; and, d) develop into a larger academic program at both the undergraduate and graduate levels.

The proposed minor will expand career options available to students, as well as provide the basic literacy on climate change and citizenship skills necessary for University of Montana students to help shape how Montana, and the nation, respond to climate change. The American Colleges and University Presidents Climate Commitment, which President Dennison signed in spring 2007, reports "Students with the knowledge and skills needed to address the critical, systemic challenges faced by global climate change will benefit from the economic opportunities that will arise as a result of solutions they develop" (ACUPCC, 2007).

The pace of job creation in a new low-carbon economy will accelerate in the years ahead. Students graduating with this minor will be prepared to pursue employment in a variety of jobs now and in the future. Such jobs exist not just in private business, but also in government offices, science and academia, land management, civil society organizations, and technology.

For the state of Montana, the actions recommended by the Montana State Climate Change Advisory Committee (CCAC, 2007), if implemented, will require trained teachers, business people, consultants, technicians, practitioners, and others in the fields of climate change and associated solutions. There are 54 separate recommendations from the CCAC including consumer education (based in the schools); marketing (of energy efficient appliances, for example); technical and practical outreach and education to farms and businesses; and well-trained professionals in the following areas: standard setting; performance monitoring; expanded agricultural extension related to climate change; and urban and transportation planning. The Montana University System will have an important role in preparing students to fill the jobs created by such recommendations. UM students completing the proposed Climate Change Studies minor will be well positioned to pursue these opportunities.

Montana businesses, non-governmental organizations (NGOs), and government agencies have expressed interest in having students in Climate Change Studies conduct research projects with their organizations. Possibilities include having students work with Missoula businesses on carbon accounting and reducing carbon emissions; develop guidelines to help citizens consider climate change within Missoula's 20-year transportation plan; identify how climate change is modifying ecological processes and conditions here in Montana; interview landowners in future wind development sites about attitudes and perceptions of wind energy; and develop outreach materials aimed at telling the story of what a warming climate means not just to fish and wildlife or ecosystems, but on the values that people derive from them, such as fishing, hunting, agriculture, hydropower production, domestic water supplies, winter recreation, and forest management. Campus-community partnerships such as these will help meet the needs of the businesses, NGOs, and agencies while providing students with vital hands-on and applied learning experience.

The basic literacy gained on the complex and multidimensional issue of climate change through this minor will become increasingly important in many professions. Thus students with this minor will be increasingly valuable and well-positioned in job searches and hiring decisions. In addition to expanded career opportunities, the structure of the minor will also help students develop more general citizenship skills. Students will be exposed to the multiple dimensions of climate change, practiced in communicating and learning across a number of disciplines, and engaged with community leaders in problem-solving. By helping develop critical thinking and problem solving skills, the program will provide students with the ability to analyze multi-disciplinary problems they may encounter in the future.

Reflecting a global trend, students across the nation are increasingly expressing interest in and concern about global climate change. Power Shift 2007 drew 6,000 students from across the nation to the White House to express concern about global warming. It was not only the largest student conference, but also the largest citizen conference ever to address the issue of climate change. Focus the Nation in January 2008 was billed as the Nation's largest-ever teach-in, with 1,500 Universities participating, each with faculty members from a wide spectrum of disciplines incorporating climate change issues into their lectures.

At the University of Montana, participation in Focus the Nation, which focused on global warming solutions, involved over 1,600 students and 35 faculty members from departments across campus (including Modern and Classical Languages, Chemistry, Geography, English, Business Technology, Applied Computing and Electronics, Wildlife Biology, and more). The spring 2008 Wilderness Institute lecture series, *Climate Change: Moving from Science to Solutions* regularly drew between 250-400 people to its lectures on climate change solutions, 144 of whom were UM students enrolled in the class for credit. A new student group, UM Climate Action Now (UM CAN),

formed last spring and now includes over 35 active members, nearly a quarter of whom are Freshmen. Student interest in solutions to climate change is further revealed by the high enrollment in clean energy technology courses. There are currently 70 students enrolled in the introductory course, *Climate Change: Science and Society*, which will be required for this minor.

Undergraduates are increasingly selecting colleges based on their environmental focus. The Princeton Review began rating colleges based on their sustainability this year and their survey asked prospective students what they were looking for in a school. Two-thirds said they would value a commitment to the environment, and nearly a quarter said it would strongly influence their choice (Kinzie, 2008). Reports show college graduates are interested in working in the environmental field. According to a 2007 GreenCareers report, “80 percent of young professionals are interested in securing a job that impacts the environment in a positive way, and 92 percent give preference to working for a company that is environmentally friendly” (MonsterTRAK, 2007). It is timely to develop a program that bridges student interest, workforce demand, and faculty focus.

3. INSTITUTIONAL AND SYSTEM FIT

The proposed minor in Climate Change Studies draws from strengths in many departments at The University of Montana. Twenty-nine faculty members from eighteen departments across campus volunteered to take part in developing this minor. A number of faculty members have made commitments to alter their course offerings to support the proposed minor. The willingness of faculty members and departments to provide these course offerings is a sign of their commitment to the minor.

This proposed minor complements the Green Thread Initiative, a curricular initiative to infuse sustainability into courses across UM through faculty training. The Green Thread Initiative will enhance the sustainability focus of some of our climate change courses, and, in turn, faculty teaching climate change courses will bolster support for the Initiative, further strengthening sustainability education across campus. The program coordinator for this minor will coordinate with and support related campus sustainability initiatives, such as projects emanating from the Sustainability Initiatives Team and the Sustainability Campus Committee, by developing climate change internship opportunities. In doing so, the proposed minor also serves to strengthen UM's climate commitment as well as the Governor's goal to reduce energy use on campus by 20% by 2010.

The proposed minor also builds upon and complements the Energy Technology (ET) A. A. S. degree program at the College of Technology. Several courses offered in the ET program fulfill the proposed minor's need for solutions-based approaches to global climate change. The ET program director will continue to work closely with the proposed program director and program coordinator for the Climate Change Studies minor (these positions are described in section 5) to identify and develop additional courses, internships, field experiences, and other educational opportunities for students in both programs.

Although the proposed Climate Change Studies minor will require several departments to add or modify courses, most of the courses proposed for inclusion in this minor are offered already. Fifteen proposed courses currently exist, five of which are currently offered as X95 courses and will require permanent listings; one course will require a course title change. Four new courses are proposed for development (see listing, section 5). Several additional courses are being developed and may be proposed for 2010 (see listing, section 5). All courses will be cross-listed with a new Climate Change Studies rubric, CCS, to help students identify all the CCS courses available within the minor. The proposed minor will also require a program coordinator to help create and facilitate opportunities for integrated and applied learning (again, see position description in section 5, Resources).

The proposed Climate Change Studies minor brings together a comprehensive interdisciplinary focus at the undergraduate level on addressing climate change. The minor combines the strengths of a focused, interdisciplinary examination of climate change with the applied, solutions-oriented learning demanded by the topic. As such, the proposed minor does not duplicate any existing programs on campus. Also, because students from any major could complete the proposed Climate Change Studies minor, it offers a way for students in any discipline to develop an understanding of climate change.

It should be noted that students can currently focus on sustainability within the Environmental Studies major, and a few experimental courses in climate change are available through that program. Similarly, students in Geoscience, Geography, and the College of Forestry and Conservation can take courses in their majors related to climate change. Several programs on campus provide an interdisciplinary focus on environment and/or conservation (including Environmental Studies, Wilderness and Civilization, Resource Conservation, and Geography) and some of these programs require service learning, internships, and other types of community engagement experiences. The Climate Change Studies minor will complement and strengthen these efforts.

The proposed minor in Climate Change Studies serves several curricular agendas. It provides the curriculum necessary to meet the President's Climate Commitment. President Dennison signed the American College & University Presidents Climate Commitment in spring, 2007, which states: "We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and *by providing the knowledge and the educated graduates to achieve climate neutrality.*" (emphasis added) The proposed minor will integrate, in conjunction with the Green Thread Initiative, climate change education into the curriculum.

The proposed minor complements elements of The University of Montana's 2006-09 Academic Plan, including enhanced community engagement. By providing opportunities for service learning through internships developed in collaboration with campus and community partners (including nonprofit organizations, government agencies, and businesses), the proposed minor will support the University of Montana's mandate for community engagement. Other applied research and project-based courses will provide direct community outreach services. These courses strengthen the UM service learning agenda and could also help support the University's Fall 2008 application to the Carnegie Council for the Advancement of Teaching for a Community Engagement Classification, a new elective classification created in 2006.

The global focus of this minor, especially in the science and society curricular areas, with coursework in international policy, economics, and global climate change science, advances the goal of educating for a global community. This will help advance a key programmatic direction of the University, which is to provide "unique educational experiences through the integration of liberal arts and professional training with international and interdisciplinary programs." Further, the proposed minor has much potential for enhancing UM's global partnerships by providing a concrete program of common concern.

The proposed minor will also provide opportunities for undergraduate research. Many courses will use pedagogies that incorporate community-based research and thereby create new opportunities to involve undergraduates in research, including faculty research and research involving collaborative partnerships in the community.

No program within the Montana University System offers an undergraduate or graduate degree in Climate Change Studies. On the national level, the only similar *interdisciplinary* degrees include an undergraduate Global Change Minor at the University of Michigan and graduate degrees at Columbia University and the University of Maine. Several Universities across the country have degree programs focused on sustainability (e.g., Arizona State University, Portland State University), and there are many non-degree granting institutions outside Montana that further

multidisciplinary education and research on climate change (such as at Duke's Center on Global Change, Rutgers' Climate and Environmental Change Initiative, The University of Maryland's Joint Global Change, University of Washington's Program of Climate Change, Yale's Project on Climate Change, Tufts Climate Initiative, Colorado State University's School of Environmental Sustainability, and more). As stated, however, few programs nationally offer undergraduate interdisciplinary degrees in Climate Change Studies.

4. PROGRAM DETAILS

The minor requires students to complete 21.0 total credits: a 3.0 credit interdisciplinary, team-taught introductory course and 6.0 credits in each of the areas listed below. To provide students with flexibility and appeal to a diversity of interests, each area will have a variety of courses to choose from, several of which will fulfill General Education requirements. Students can choose any course in each of the three areas, totaling at least 6.0 credits.

The interdisciplinary undergraduate minor in Climate Change Studies will be coordinated by a program director, program coordinator, and advisory board. Students will declare their minor to the program director, who will review their course of study, advise students on planning their course sequence, and approve their graduation petition.

The areas of study are:

A. Climate Change Science (natural and physical sciences)

The climate change science area introduces students to the basic processes by which the biosphere, atmosphere, hydrosphere, lithosphere, and cryosphere interact to produce and respond to climatic change.

B. Climate Change and Society (social sciences and humanities)

The climate change and society area provides students with the opportunity to evaluate the social, political, economic, and ethical dimensions of climate change on the local, national, and international levels.

C. Climate Change Solutions (practical application)

The climate change solutions area creates opportunities for students to study and engage in solutions to global climate change. Course options range from studies of clean energy technology and sustainable business to internships and other applied coursework that engages students in solutions to climate change.

Proposed catalogue copy:

Climate Change Studies is an interdisciplinary program open to all majors. The program educates students in three areas of the climate change issue: science, society, and solutions. Coursework in the minor provides a foundation that enables students to engage the scientific, societal and political dimensions of global climate change. Further, the focus on solutions with its orientation toward applied learning will help students develop critical thinking and problem solving skills. Participating students will enhance their major field of study. They will be better prepared to enter a broad range of professions and graduate programs where they can meet the emerging challenges and opportunities arising from climate change. The minor takes advantage of faculty expertise and diverse courses to provide a unique interdisciplinary, integrated, and innovative program.

Requirement for a Minor

Students must complete successfully 21.0 credits: a 3.0 credit interdisciplinary introductory course and 6.0 credits in each of the three areas listed below.

Introductory Course

CCS 203 Climate Change: Science and Society, 3 cr

Six credits from the following area:

1. Climate Change Science Courses

GEOS/CCS 108N Climate Change – Past and Future, 3 cr

GEOG/CCS 322N Weather and Climate, 3cr

GEOS/CCS 382 (UG) Global Change, 3 cr

FOR/DBS/GEOS/CCS 407 (UG) Global Biogeochemical Cycles, 3 cr

GEOS/CCS 488 (UG) Snow, Ice and Climate, 3 cr

Six credits from the following area:

2. Climate Change and Society Courses

COMM/EVST/CCS 379 Communication, Consumption, and Climate, 3 cr

PSC/CCS 324 Sustainable Climate Policies: China and the USA, 3 cr

RSCN/EVST/CCS 449E (UG) Climate Change Ethics and Policy, 3 cr

ECON/CCS 445 (UG) International Environmental Economics and Climate Change, 3 cr

Six credits from the following area, with at least one course taken in category A, which requires practical application:

3. Climate Change Solutions CoursesCategory A

NRG/CCS 290 Energy Internship, 2 cr

CCS 398 Climate Change Internship, 2-4 cr

CCS 391 Climate Change Practicum, 2-4 cr

EVST/CCS 485 Environmental Citizenship, 3 cr

Category B

NRG/CCS 102 Introduction to Energy Systems II, 3 cr

BUS/CCS 160S Issues in Sustainability, 3 cr

NRG/CCS 191 Energy Practicum, 2 cr

CAR/CCS 235T Building Energy Conservation, 3 cr

NRG/CCS 242 Solar and Wind Systems, 3 cr

Course Schedule

See attached schedule of course offerings, providing a representative calendar of courses available to students in this minor, indicating what year and semester each course will be offered, including the phase-in of new proposed courses. Given the proposed course schedule, students should be able to fulfill this minor within two to four years while at the University of Montana.

Two-Year Option

1st year	Fall Semester:	Introductory course
	Spring Semester:	1 course in science and 1 in society
2nd year	Fall Semester:	1 course in science and 1 in society
	Spring Semester:	2 courses in solutions

Four-Year Option

1st year	Fall Semester:	Introductory course
	Spring Semester:	1 course in science or society
2nd year	Fall Semester:	1 course in society or society
	Spring Semester:	1 course in science or society
3rd year	Fall Semester:	1 course in society or society
	Spring Semester:	1 course in solutions
4 th year	Fall Semester:	1 course in solutions

5. RESOURCES

The proposed minor in Climate Change Studies will require additional personnel and new course approvals.

Additional Personnel

The proposed minor will require a program director. The responsibilities of the director will include: (1) advising students; (2) working with faculty on curriculum development; (3) working with the advisory committee to approve new courses; (4) writing grants and helping raise the funds necessary to support the program; (5) developing internal and external partnerships to enhance the program; and, (6) teaching one course per year in the program.

The proposed minor will also require a program coordinator. The responsibilities of the program coordinator will include: (1) working with faculty to facilitate decision-making and curriculum development; (2) program promotion, website development, and student recruitment; (3) advising assistance; and (4) conducting program assessments and preparing an annual report. The program coordinator will also be responsible for the solutions area of the curriculum. This will involve working with partners to develop internship, research, and service learning projects, and matching students with projects based on their interests and professional goals.

Dr. Steve Running will be the program director. At the outset, the director will not require additional compensation, and this will be reviewed as the enrollment for the program grows. Nicky Phear has agreed to serve in the role as program coordinator as a modification of her current duties in the Wilderness in Civilization program. She will serve on a part-time basis at the beginning, and her commitment will be reviewed as enrollment in the program grows. Beginning in the spring 2009, the program director and program coordinator will seek external funding to supplement state support of the minor program.

Additional Courses

The proposed minor will require nine new courses (approved), five of which (*starred below) are currently offered as experimental X95 courses:

- 1) *CCS 203 Climate Change: Science and Society, 3 cr
(currently FOR/EVST/GEOG/GEOS 295 Climate Change: Science and Society, 3 cr)
- 2) *FOR/DBS/GEOS/CCS 407 Global Biogeochemical Cycles, 3 cr
(currently FOR/DBS/GEOS 495 Introduction to Biogeochemistry, 3 cr)
- 3) *RSCN/EVST/CCS 449E Climate Change Ethics and Policy, 3 cr
(currently EVST 495 Climate Change Ethics and Policy, 3 cr)
- 4) *EVST/CCS 485 Environmental Citizenship, 3 cr
(currently EVST 495 Environmental Citizenship, 3 cr)
- 5) *NRG/CCS 242 Solar and Wind Systems, 3 cr
(currently NRG 295T Solar and Wind Systems, 3 cr)
- 6) ECON/CCS 445 International Environmental Economics and Climate Change, 3 cr
- 7) PSC/CCS 324 Sustainable Climate Policies: China and the USA, 3 cr
- 8) CCS 398 Climate Change Internship, 2-4 cr
- 9) CCS 391 Climate Change Practicum, 2-4.0 cr

The proposed minor will also require the approval of one course title change:

- 1) COMM/EVST/CCS 379 Communication, Consumption, and Climate, 3 cr
(currently COMM/EVST 379 Consumption, Media, and the Environment)

Future Additional Courses

The following courses are being considered for development and future inclusion in the minor. There will be a submission process whereby courses will be submitted to and vetted by the program director, three-person advisory committee, and program coordinator. Some courses may require additional funding in order to be developed.

- FOR/DBS/CCS 395 Ecology and Climate Change, 3 cr
- GEOG/CCS 395 International Perspectives on Climate Change, 3 cr
- PHIL/CCS 295 Environmental Ethics and Climate Change, 3 cr
- SOC/CCS 470 Society, Environment, and Climate Change, 3 cr
(An existing course may be proposed with revision and new title)
- BMED/CCS 495 Public Health and Climate Change

Additional Resources

Dr. Steve Running will be the program director, assisted by Nicky Phear, the program coordinator. Dr. Running's laboratory, the Numerical Terradynamic Simulation Group within the College of Forestry and Conservation, will provide office space and operating expenses for the program coordinator. As stated, beginning in spring 2009, the program director and program coordinator will seek external funding to supplement state support of the Climate Change Studies minor program.

Current Faculty

The faculty members and university affiliates who have been part of this curricular development task force and who will be involved with the program proposed herein are:

Richard Barrett, Emeritus Professor, Department of Economics
 Rebecca Bendick, Assistant Professor, Department of Geosciences
 Len Broberg, Professor, Department of Environmental Studies
 James Burchfield, Associate Dean and Research Professor, College of Forestry and Conservation
 Cory Cleveland, Assistant Professor, College of Forestry and Conservation
 Georgia Cobbs, Associate Professor, Department of Curriculum and Instruction
 Michael DeGrandpre, Professor, Department of Chemistry
 Joel Harper, Assistant Professor, Department of Geosciences
 Faith Ann Heinsch, Research Scientist, College of Forestry & Conservation
 Martin Horejsi, Assistant Professor, Department of Curriculum and Instruction
 Ulrich Kamp, Assistant Professor, Department of Geography
 Derek Kellenberg, Assistant Professor, Department of Economics
 Brian Kerns, Engineer/Res & Spon Prog, Research Administration
 Anna Klene, Assistant Professor, Department of Geography
 Peter Koehn, Professor, Department of Political Science
 Rachel Loehman, GIS Specialist/Climate Change Analyst, Department of Education/College of Forestry and Conservation
 Nicky Phear, Adjunct Instructor, Wilderness and Civilization Program
 Anna Prentiss, Associate Professor, Department of Anthropology
 Ashley Preston, Program Director, Energy Technology Program
 Christopher Preston, Assistant Professor, Department of Philosophy
 Rebecca Richards, Professor, Department of Sociology
 Steve Running, Professor, College of Forestry & Conservation
 Robin Saha, Assistant Professor, Department of Environmental Studies
 Dane Scott, Director, Center of Ethics, Associate Professor, Resource Conservation
 Steve Schwarze, Associate Professor, Department of Communication Studies
 Lisa Swallow, Program Director, Department of Business Technology
 Terry Weidner, Director, Mansfield Center
 Nadia White, Assistant Professor, School of Journalism

Laurie Yung, Director, Wilderness Institute

6. ASSESSMENT PLAN

The interdisciplinary minor in Climate Change Studies will be housed jointly in the College of Forestry and Conservation and the College of Arts and Sciences. The program will be administered by the program director, program coordinator, and a Climate Change Studies advisory committee.

The program director will be the academic advisor for the proposed minor, and will meet with students signing up for the minor and at their completion. The program coordinator will assist the program director with student advising and curriculum issues (e.g. scheduling, reviewing and making recommendations regarding student requests). Student learning outcomes will be established, and student work will be assessed against these learning outcomes using various assessment tools. The program director and coordinator will prepare an annual report on activities, needs, and outcomes (number of students participating in the minor by major, course enrollments, scheduling, internship and job placements, learning outcomes, etc.). The report will be submitted to the Provost; Deans of the College of Arts and Sciences, College of Forestry and Conservation, College of Technology, School of Business Administration, and Davidson Honors College; and all Departments with faculty teaching in the program.

The advisory committee will be made up of three faculty members, one from each of the three areas: science, society, and solutions, elected for staggered three-year terms. All faculty teaching core courses will be eligible to vote and serve. Members of the initial committee will be elected for one-, two-, and three-year terms to ensure continuity.

6. PROCESS LEADING TO SUBMISSION OF PROPOSAL

This proposal was prepared by members of a climate change curriculum task force convened by Provost Royce Engstrom in December 2007. The task force includes 29 faculty members from across campus and represents a wide range of disciplines. The task force met every two to three weeks from December through May. Faculty subgroups were formed within each of the three curricular areas—science, society, and solutions—to develop focus and identify existing courses suitable to each area. Several undergraduate and graduate students read the proposal and offered input. Local conservation, city and business organizations also provided input on potential internships and community research projects, as well as anticipated knowledge, skills, and training that would be useful for graduates of this program. The result is this proposal for an interdisciplinary, cross-campus minor in Climate Change Studies that integrates studies of science, society, and solutions. No specific accrediting agency reviewed and approved this program.

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Appendix A

Climate Change Studies Course Descriptions

Introductory Course

U CCS 203 Climate Change: Science and Society, 3 cr. Offered autumn. This is a foundational course on the scientific and social dimensions of global climate change. The goal of this course is to provide students with a basic understanding of the fundamental scientific, social, political and technological issues arising from rapid climatic change. To fulfill this goal the course has three major objectives. Students will be able to: (1) demonstrate an understanding of the basic science of climate change, (2) articulate and discuss the important ethical, social and political issues arising from global warming, and (3) critically analyze and discuss possible reactions and solutions to the threat of human-caused climatic change.

Climate Change Science

U GEOS 108N Climate Change – Past and Future, 3 cr. Offered autumn. Same as CCS 108N. The geoscience perspective on the earth's climate system. Climate processes and feedbacks, climate history from early earth to the ice ages, present and future changes due to natural processes and human activities.

U GEOG 322N Weather and Climate, 3cr. Offered autumn odd-numbered years. Same as CCS 322N. Prereq., GEOG 102N or consent of instr. Origin, composition, structure, and dynamics of the atmosphere, gas and radiation laws, energy budget and balance, weather elements and North American weather systems.

UG GEOS 382 Global Change, 3 cr. Offered intermittently. Same as CCS 382. Prereq., consent of instr. Lectures, readings, and discussions on geological and geochemical processes that affect global change using recent literature; carbon dioxide buildup, greenhouse effect, ozone depletion, desertification, ice ages, and other global events.

UG FOR 407 Global Biogeochemical Cycles, 3 cr. Offered spring odd numbered years. Same as DBS/GEOS/CCS 407. Six elements – carbon, oxygen, hydrogen, nitrogen, sulfur and phosphorus make up 95% of the mass of Earth's biosphere, and provide the biochemical foundation for all of life. The global cycles of these elements in their biological, geological and chemical forms constitute the biogeochemical cycles. Human activities are driving profound changes in these cycles, with potentially devastating effects. Increases in atmospheric CO₂, global climate change, increases in the use of inorganic N and P fertilizers, ozone depletion, among others, are all happening at unprecedented rates. In this course, we explore how variations in the availability or utilization of these and other critical Earth elements influences the atmosphere, the oceans, and the terrestrial biosphere including the natural and agricultural ecosystems on which we depend.

UG GEOS 488 Snow, Ice and Climate, 3 cr. Offered spring. Same as CCS 488. Prereq., MATH 100. Study of basic physical processes occurring in snow and ice, and how these processes govern the interaction between frozen water and the climate system. The first half of the course focuses on snow, with special attention to snow formation in the atmosphere, snow metamorphism, water flow through snow, and basic avalanche mechanics. The second half of the course focuses on ice and includes glacier and ice sheet flow dynamics, glacier hydrology, and ice age theory. Graduate students will be required to complete additional problem sets requiring higher level math; perform additional reading assignments; perform at a higher level on assignments and exams where students are asked to outline and describe various physical

processes; submit a well researched and reference research proposal that is able to synthesize previous research and provide a sophisticated research plan.

Climate Change and Society

U PSC 324 Sustainable Climate Policies: China and the USA, 3 cr. Offered every other year. Same as CCS 324. Prereq., CCS 203 or consent of instructor. Explores historic, current, and future greenhouse-gas (GHG) emissions of the United States and China, reasons why both are the two largest CO₂ emitters, and prevailing national and subnational government policies and nongovernmental actions that affect emissions mitigation and adaptation. The principal constraints on and opportunities for policy change in both countries will be identified and critically analyzed within a climate-stabilization and issue-bundling framework. Attention to improved and feasible local, regional, national, or transnational GHG-mitigation or climate-change adaptation policies.

U COMM 379 Communication, Consumption and Climate, 3 cr. Offered every other year. Same as EVST 379 and CCS 379. Analyzes consumption as a communication practice, investigates discourses that promote consumption, and explores how communication shapes perception of consumption's climate impacts.

UG ECON 445 International Environmental Economics and Climate Change, 3 cr. Offered autumn every other year. Same as CCS 445. Prereq., ECON 111. Students will be introduced to the economics of various policy approaches towards climate change and other international environmental issues such as trans-boundary pollution problems, international trade and the environmental, and the pollution haven hypothesis.

UG RSCN 449E Climate Change Ethics and Policy, 3 cr. Offered spring. Same as EVST 449E and CCS 449E. This course focuses on the ethical dimensions of climate change policy. It will cover the following major topics: (1) climate change, personal and collective responsibilities, (1) ethics, climate change and scientific uncertainty, (2) distributive justice and international climate change negotiations, (3) intergenerational justice and climate change policy.

Climate Change Solutions

U CCS 398 Climate Change Internship, 2-4 cr. Offered autumn and spring. This course gives students an opportunity to gain hands-on, "real world" experience working with a local, regional, national or international group to address climate change. Students gain supervised, practical work experience with specific projects and organizations; create a network of professional contacts; and have opportunity to apply ideas and approaches studied in the Climate Change Studies minor.

U CCS 391 Climate Change Practicum, 2-4 cr. Offered autumn and spring. Prereq. CCS 203 and consent of instructor. Students design and implement a capstone project involving creative solutions to climate change. Project proposal, narrative activity log, documentary report, and public presentation required. Honors credit available.

U NRG 290 Energy Internship, 2 cr. Offered spring. Same as CCS 290. Students will complete a field experience at an energy-related site or in an energy-related industry. This experience increases student competency in the field, prepares the student for initial employment, and increases occupational awareness and professionalism. A series of career development seminars and activities related to the field experience are completed in parallel.

U EVST 485 Environmental Citizenship, 3 cr. Offered spring. Same as CCS 485. Open to juniors and seniors only or by permission of instructor. Develops environmental citizenship through student-initiated projects informed by principles of social marketing.

U NRG 102 Introduction to Energy Systems II, 3 cr. Offered spring. Same as CCS 102. This course is a survey of renewable energy systems and technologies. The course addresses the physical and technical aspects of wind, solar, geothermal, hydro, tidal, biological, and wave energy systems. Consideration is also given to the engineering, economic, social, environmental, and political factors that determine implementation and sustainability. Spring only.

U BUS 160S Issues in Sustainability, 3 cr. Offered autumn and spring. Same as CCS 160S. This literature-intensive course is intended to expose the student to a variety of essays addressing the balance of economic development with the principles of sustainability and social equity. The student is offered an introduction to sustainability concepts, natural systems/cycles and environmental economics. Natural capitalism and triple bottom line maximization is explored, along with the role of corporations and small businesses in sustainable development. A survey of issues surrounding corporate social responsibility and sustainability-driven innovation will be conducted.

U NRG 191 Energy Practicum, 2 cr. Offered summer. Same as CCS 191. The practicum provides students with a supervised field experience. Students will gain hands-on experience with energy specific technologies. This opportunity increases students' occupational awareness and professionalism.

U CAR 235T Building Energy Conservation, 3 cr. Offered spring. Study of the analysis techniques for reduction of energy consumption and energy management, including energy accounting and energy auditing. Residential and commercial building energy efficiency opportunities are covered. Other topics include motors, pumps, green building, purchasing energy supplies, and careers in energy efficiency.

U NRG 242 Solar and Wind Systems, 3 cr. Offered spring. Same as CCS 242. Solar and Wind Systems is an introduction to the fundamentals of solar and wind energy for the design and installation of solar and wind systems. The material covered will prepare students for a career in renewable energy or for installing a renewable energy system on their own home.

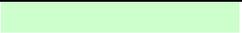
Appendix B: Climate Change Studies (CA Studies) Representative Calendar of Courses Expected to be Available to Students

	Spring 2009	Fall 2009	Spring 2010	Fall 2010	Spring 2011	Fall 2011	Spring 2012
Intro	CCS 203 (CA: Sci&Soc)	CCS 203 (CA: Sci&Soc)		CCS 203 (CA: Sci&Soc)		CCS 203 (CA: Sci&Soc)	
Science	<p>GEOS 382 (Global Change)</p> <p>GEOS 488 (Snow,Ice&C) FOR/DBS/GEOS 407 (Biogeochem.)</p>	<p>GEOS 108N (CA-Past&Fut.) GEOG 322N (Weather&Clim)</p>	<p>GEOS 382 (Global Change) GEOS 488 (Snow,Ice&C)</p> <p>CCS 395 (Ecology and CA)</p>	<p>GEOS 108N (CA-Past&Fut.) GEOG 322N (Weather&Clim)</p> <p>BMED 495(Public Health)</p>	<p>GEOS 382 (Global Change) GEOS 488 (Snow,Ice&C) FOR/DBS/GEOS 407 (Biogeochem.)</p> <p>CCS 395 (Ecology and CA)</p>	<p>GEOS 108N (CA-Past&Fut.) GEOG 322N (Weather&Clim)</p> <p>BMED 495(Public Health)</p>	<p>GEOS 382 (Global Change)</p> <p>GEOS 488 (Snow,Ice&C)</p> <p>CCS 395 (Ecology and CA)</p>
Society	<p>COMM/EVST 379 (Consumption)</p> <p>RSCN/EVST 449E (CA Ethics)</p> <p>PSC 324 (SCP:China&USA)</p>	<p>ECON 445 (Economics of CA)</p>	<p>RSCN/EVST 449E (CA Ethics)</p> <p>PSC 324 (SCP:China&USA)</p>	<p>PHIL 295(Env.Ethics&CA)</p> <p>GEOG 495 (International Persp)</p>	<p>COMM/EVST 379 (Consumption)</p> <p>RSCN/EVST 449E (CA Ethics)</p> <p>PSC 324 (SCP:China&USA)</p> <p>SOC 470 (Sociology of CA)</p>	<p>ECON 445 (Economics of CA)</p> <p>PHIL 295(Env.Ethics&CA)</p> <p>GEOG 495 (International Persp)</p>	<p>RSCN/EVST 449E (CA Ethics)</p> <p>SOC 470 (Sociology of CA)</p>
Solutions	<p>NRG 290 (Energy Internship)</p> <p>EVST 485 (Env.Citizenship)</p> <p>BUS 160S (Sustainability)</p> <p>NRG 102(Renewable Energy)</p> <p>CAR 235T (Energy Conservation)</p> <p>NRG 242 (Solar and Wind)</p>	<p>BUS 160S (Sustainability)</p>	<p>CCS 398 (CA Internship) CCS 391 (CA Practicum)</p> <p>NRG 290 (Energy Internship) EVST 485 (Env.Citizenship) BUS 160S (Sustainability) NRG 102(Renewable Energy) CAR 235T (Energy Conservation) NRG 242 (Solar and Wind)</p>	<p>CCS 398 (CA Internship) CCS 391 (CA Practicum)</p> <p>BUS 160S (Sustainability)</p>	<p>CCS 398 (CA Internship) CCS 391 (CA Practicum)</p> <p>NRG 290 (Energy Internship) EVST 485 (Env.Citizenship) BUS 160S (Sustainability) NRG 102(Renewable Energy) CAR 235T (Energy Conservation) NRG 242 (Solar and Wind)</p>	<p>CCS 398 (CA Internship) CCS 391 (CA Practicum)</p> <p>BUS 160S (Sustainability)</p>	<p>CCS 398 (CA Internship) CCS 391 (CA Practicum)</p> <p>NRG 290 (Energy Internship) EVST 485 (Env.Citizenship) BUS 160S (Sustainability) NRG 102(Renewable Energy) CAR 235T (Energy Conservation) NRG 242 (Solar and Wind)</p>

Additional Courses:	Summer Session --	NRG 191 Energy Practicum, 2 cr (fulfills Solutions Course Area)
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Indicates new course proposed



Indicates possible proposed future course

Appendix C
Letters of Support

Montana Board of Regents
Office of Commissioner of Higher Education
Montana University System
46 N. Last Chance Gulch
PO Box 203201
Helena, MT 59620-3201

September 15, 2008

MT Board of Regents:

The proposed Climate Change Studies minor would not only serve as a leading and timely addition to the curriculum at the University of Montana, but more importantly it would demonstrate UM's commitment of being an institution that is dedicated towards providing a high-level, well-rounded education for its students. In the world we live in today, the issue of climate change is omnipresent—encompassing all social, political, and economic issues facing our globe. It only seems obvious to provide students the opportunity to fully understand all of the challenges associated with climate change, and empower them with the tools and resources to confront these challenges and work towards solutions.

Last year the University of Montana hosted one of 1,400 climate change “teach-in’s” as a part of the nation-wide event *Focus the Nation*. UM’s event was considered one of the top 100 events held across the country, which is not surprising considering the attention and support the event received on campus. At UM over 35 faculty members, from a variety of disciplines, incorporated the subject of climate change into their daily classes reaching out to more than 1,000 students on campus. The response from the faculty, the support from the administration, and the reaction from the students, only emphasized the need to create a formal outlet for this type of teaching.

Campuses across the country are beginning to establish Sustainability Offices and some are even changing their mission statements to incorporate sustainability and the notion of climate neutrality. Leadership is needed to face the challenges that climate change poses, and those leaders will come from the youth, from well-educated university students.

I strongly support the adoption of the Climate Change Studies minor at the University of Montana.

Sincerely,

Jessie Davie
ASUM Sustainability Coordinator



The University of
Montana

College of Technology
The University of Montana
909 South Avenue West
Missoula, Montana 59801-7910
Phone: (406) 243-7811
FAX: (406) 243-7899

September 15, 2008

RE: Climate Change Studies Minor

On behalf of the Department of Applied Computing and Electronics, I would like to express my enthusiasm and support for the proposed *Climate Change Studies* minor. The significance of global climate change and its impact on species and society is well documented. The minor will increase awareness and engagement of scientific, societal, and political issues surrounding the subject.

Our department is home to the *Energy Technology A.A.S* degree program. The program's focus is to educate students in traditional, transitional, alternative, and emerging energy technologies. We welcome students from the *Climate Change Studies* minor to participate in these courses. Furthermore, we are excited to be involved with the "Climate Change Solutions" component of the minor.

I encourage support for this important program.

Sincerely,

Thomas Gallagher, Chairman
Department of Applied Computing and Electronics

An Equal Opportunity University

ITEM -142-1005-R0109

Approval to establish a Masters of Science in Special Education

THAT:

In accordance with Montana University System Policy, the Board of Regents of Higher Education authorizes The University of Montana—Missoula to establish a Masters of Science in Special Education

EXPLANATION:

Special education and education in general are experiencing rapid changes largely guided by a movement toward inclusion and accountability for all students. There is a national shortage of special educators and this is especially true in Montana. Also, there is a shortage of advanced degrees in special education in Montana as evidenced by many special educators receiving a master's degree in general education.

This program will offer courses and experiences that are in-line with current research and evidence-based practices. The flexibility of the program will allow students to make choices that best meet their professional needs. Pre-service and in-service teachers will have experiences that will prepare them to make a significant impact on students and schools in Montana.

ATTACHMENTS:

Attachment A: Letters of Support
Attachment B: Mansfield Library Review

M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.: 142-1005-R0109A		Date of Meeting:	January 7-8, 2009
Institution:	The University of Montana—Missoula		
Program Title:	Establish a M.S. in Special Education		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

The University of Montana – Missoula requests permission to establish a Masters in Special Education.

Objectives and Needs

A Master's of Science in Special Education has been the top priority of the faculty in the Department of Curriculum and Instruction at The University of Montana since the 2006-2007 academic year. The addition of a Master's in Special Education to the curriculum addresses the University's strategic goal to strengthen and broaden graduate and research programs. As will be articulated in this proposal, there is a great need to offer advanced training in the field of Special Education to professionals in the state and the region. Also, this graduate program would serve as a platform for other graduate programs and endorsements. The need for this program is apparent when one examines local, state, regional or national data.

Program Goals

1. Provide advanced information and training to graduate students and in-service professionals in the field of Special Education.
2. Address the requirements of recent legislation and provide training in research to prepare Special Education professionals to make data-driven decisions that lead to the best possible outcomes for students.
3. Better serve existing students by providing current information and skills that will prepare students for the changing landscape of special and general education; enrich current offerings in special education beyond an initial endorsement already offered by the department.
4. Allow the University to address the needs of local, state, regional and national communities.
5. Develop a new market to increase student enrollment.
6. Complement other growth initiatives that are proposed for the School of Education and the University as a whole.

Intellectual basis for the curriculum

It is clear that P/K-12 education is in a time of great change. The passage of the No Child Left Behind Act (NCLB; 2001) and the Individuals with Disabilities Education Improvement Act (IDEA; 2004) have made it clear that public school professionals must address the need of students who have been traditionally underserved with the use of scientifically based instructional methods. This advancement in P/K-12 settings has made clear the need for institutions of higher education to provide training regarding (a) instructional methods to address the needs of students with identified disabilities and those who are at-risk (b) procedures to make data-driven decisions and (c) application of techniques and strategies that have a foundation in applied research.

Since the passage of the Education for All Handicapped Children Act (EHA; now IDEA) in 1975, American public education has largely functioned as a dual and often competing system; general and special education. Yet it was never intended that special education develop into a comprehensive *separate* service delivery system; it was intended to ensure that the needs of children and youth with disabilities be addressed in typical educational settings. Over the years, rather abysmal outcomes for "graduates" of special education programs, and the misidentification of children labeled as requiring special education (largely from minority populations) have led advocates and policy-makers to several state and federal systems change initiatives, resulting in new legal mandates calling for more collaboration and cooperation between general and special educators, and access to general education curricula for all students, regardless of the presence of disability. The dual system has been deemed discriminatory and ineffective. Therefore, future steps in the preparation of educators must be focused on how to collaborate effectively, how to prevent students from being erroneously identified for special education services (or not identified when services are warranted) and when identified for services, how to best provide research-based programs and interventions which treat students as general education students first.

Not only is there an intellectual need for a Master's in Special Education, there is a practical need for the program.

Need for Program

There are a variety of reasons to create this program, both in terms of what the field is demanding and in how best to serve our current students. In regard to the field of special education, this program is needed for the following reasons: to help meet a chronic and persistent shortage of qualified special education teachers; to provide advanced information and training to in-service professionals; to respond to the requirements of recent legislation; and to provide training that will allow the state of Montana to develop leaders in special education professionals. The development of this program would allow the University to better serve existing students, to respond to local, regional and national needs, to develop a new market, and to complement other

growth initiatives that are proposed for the School of Education and the entire University. Each of these needs is discussed below.

The addition of a Master's level program will draw new people (e.g., general educators, psychology majors, social workers) into the field of special education. Attracting new teachers into special education is critical because of the severe and chronic need for special educators, both nationally and in Montana. Nationally, the *25th Annual Report to Congress* (OSERS, 2005) stated that since 1992 the number of children receiving services under IDEA has slowly but steadily increased (with the exception of students with autism, which has increased dramatically in recent years). This increased need for services only exacerbates the already acute need for trained professionals. The *President's Commission on Excellence in Special Education* (PCESE, 2001) reported that nationally more than 12,000 special education openings were left vacant; and, that 10% of the filled positions were held by unqualified personnel (with higher percentages in some states).

Although this is a national problem (98% of school districts nationally reported shortages in personnel qualified to teach receiving services under IDEA) Montana is no exception. In fact, some of the characteristics of Montana (e.g., the large geographic region and the small population base of the state) have made filling special education positions with qualified personnel challenging. The Educator Licensure and Accreditation Division of the Office of Public Instruction in Montana lists special education among the areas in most need of new teachers (2006). The State Superintendent describes these vacancies as either "very hard" or "difficult" to fill (McCulloch, 2005). In addition, roughly 7 - 10% of the teachers in Montana who currently teach students with disabilities are unqualified.

In addition to the need for recruiting new personnel, there is a need for high-quality, specialized preparation for the cohort of new trainees and for those already practicing in the field. The lack of qualified special education teachers ultimately has a deleterious effect on student outcomes. The *25th Annual Report to Congress* reports that 41.1% of students over the age of 14 with disabilities drop out of school (OSERS, 2005). In addition, the U.S. Department of Education reported that nationally 13% of the schools that did not meet adequate yearly progress (as defined by the No Child Left Behind Act) did so based solely on the scores of the special education students. These poor outcomes for students with disabilities can begin to be remediated by providing them with well-qualified teachers. To be endorsed in Montana to teach special education, one must first be certified as a general education teacher, then complete additional course work to earn a special education endorsement. The coursework offered in special education now at The University of Montana is sufficient for the state's endorsement, which results in an initial credential. However, there is a critical need to address a vast array of specialized information beyond the scope of the initial course work. By expanding the course offerings to systematically address missing content, more advanced information will be taught. The ultimate benefit will be that children and students receiving special education services from our graduates will receive better quality services.

There is no question that NCLB has had an impact on education. One of the many changes it has brought is redefining what constitutes a "highly qualified" teacher. The Individuals with Disabilities Education Improvement Act of 2004 specifically emphasizes the qualifications of special education teachers. There is an emphasis on content knowledge, which parallels the ideas and language in the NCLB. Thus, special education teachers of the future will need to be expert in content knowledge, in addition to knowledge of special education. For example, to be qualified to teach math to students with disabilities in high school, the teacher must show content knowledge in math, even if the students they are teaching are not yet learning high school level math. This has practical implications for students interested in teaching special education at the secondary level in Montana. They will need to acquire subject matter content knowledge and a general education teaching license before they can begin special education course work. Given the number of credit hours this takes, students would be qualified to graduate before they even begin their specialized course work; this is even more problematic for students seeking to become elementary special education teachers. Thus, the proposed program provides an avenue for students needing to meet the new qualifications. A Master's level degree program will allow students to continue their education and obtain an advanced degree.

Obtaining a Master's degree in special education is important not only because it is an indication that teachers are highly trained or qualified. It is also a necessary degree for increasing the number of leaders in special education and related fields. Just as there are chronic shortages of special education teachers, there is a gap in the number of special education doctoral recipients and the relatively large number of higher education faculty positions (Pion, et al., 2003). This results in university students receiving their training from under-qualified faculty. This problem is magnified in Montana where none of the institutions of higher education train doctoral-level special educators. The lack of doctoral-level trainees in Montana creates many problems (e.g., lack of qualified higher education faculty, lack of leadership knowledge in the state); a first step to remediate this problem is to develop a Master's level program. Obtaining a Master's degree is frequently the

first step in recruiting students to seek terminal degrees and leadership positions in special education and related fields.

In addition to the many needs outlined above, the proposed program would also meet some existing needs at the University of Montana. First, the proposed program would better serve students already studying or having an interest in studying special education. Specifically, this would be done by expanding current course offerings, allowing for greater emphasis in areas our graduates consistently identify as needing more attention (e.g., behavior management; instructional and assessment practices - especially with regard to children and youth experiencing low-incidence disabilities; and family and multi-cultural issues, including but not limited to Native American studies).

Second, the proposed program will allow the University to respond to local, regional, and national needs. The shortage of new teachers entering the field of special education has already been stated. By creating this new program, we will attract new students from other fields (e.g., general educators, psychology majors, social workers) for whom obtaining a graduate degree is important. Further, the proposed program will put our faculty in a much better position to seek external funds to help support students. Thus, the proposed program would both be attractive to potential students as well as to funders who support students.

Third, creation of this program would provide additional training for special education teachers already in the field. Non-Masters degree level special education teachers would benefit from learning new material to become more effective and current. In addition, those who obtain a Master's Degree would be eligible for higher compensation.

Finally, the creation of a Masters-level program in special education would support several growth priorities in both the School of Education and the University. The School of Education now houses the new Communicative Sciences and Disorders program, which is commencing both graduate and undergraduate level programs in a field related to special education. The students in this program would benefit from much of the course work developed for the special education Master's program. In addition, the Department of Educational Leadership and Counseling has as its top academic proposal to develop a training program in Special Education Administration. To earn this degree, one must first hold a Master's degree in Special Education. Thus, this proposal supports other growth efforts. Finally, we believe that the creation of this Master's level program will be the basis on which much external funding can be sought, and the foundation for eventually developing a terminal degree program in special education; thus the Master's program we are seeking is closely aligned both with the University's funding priorities, and its focus on research and graduate degree programs (see letters of support in Attachment A).

Course of study-with draft catalog copy of specific courses required and recommended for completion of the degree program, major, major subset, or minor; with course rubric (dept. & number), credits, course title-indicating required elective, and other courses. Asterisk those which would be new if the program were implemented as proposed.

Current Endorsement Courses:

C&I 453	Intro to Special Education Law and Policy	3 cr.
C&I 433/533	Advanced Diagnosis & Correction of Reading/Writing	3 cr.
C&I 457	Assessment & Instruction for Exceptional Learners	5 cr.
C&I 459	Consulting/Resource Teacher	3 cr.
C&I 463	Advanced Classroom Management for Exceptional Learners	3 cr.
C&I 469	Student Teaching in Special Education	10 cr.
	Elective	2-3 cr.
Total		29-30 cr.

New Endorsement Courses Including Courses that have Changed

C&I 453	Special Education Law, Policy & Practices	3 cr.
C&I 433/533	Advanced Diagnosis & Correction of Reading/Writing	3 cr.
C&I 452	Measurement and Observation	3 cr.*
C&I 458	Effective Academic Intervention	3 cr.*
C&I 463	Advanced Positive Behavioral Supports	3 cr.
C&I 469	Student Teaching in Special Education	9 cr.
C&I 420 or	Elective	3 cr.
Elective		3 cr.
Total		30 cr.

Here is how the endorsement is going to change:

CI 453 changes to include portions of CI 459. Student teaching is reduced by 1 credit hour. C&I 457, Assessment & Instruction for Exceptional Learners (5 cr.) and C&I 459, Consulting/Resource Teacher (3 cr.) would be deleted.

Master's of Science Degree in Special Education

Graduate students who enter the program with an endorsement must take a total of 36 graduate level course. At least 26 of the credits must be from the list below and include advisor approved electives:

Course	Course Title	Credits	Semesters
C&I 524	Family and Diversity Issues for Exceptional Learners	3	Fall and Even Summers*
C&I 526	Transition and Community Supports	3	Spring and Odd Summers*
C&I 452	Measurement and Observation	3	Fall and Even Summers*
C&I 556	Advanced Methods in Low Incidence Disabilities	3	Spring and Odd Summers*
C&I 523	Advanced Methods in Early Childhood Special Education	3	Spring and Odd Summers*
C&I 458	Effective Academic Intervention	3	Fall and Even Summers*
C&I 560	School-wide Assessment and Instruction: Response to Intervention	3	Spring and Odd Summers*
C&I 463	Advanced Positive Behavioral Supports	3	Spring and Odd Summers
C&I 520	Educational Research	3	All Semesters
C&I 522	Applied Research Methods	3	Fall and Even Summers*
C&I 518	Inclusion and Collaboration	3	Even Fall and All Summers
	Electives (including thesis option)	6 credits	All Semesters
	Total	36	

Graduate students who enter the program without an endorsement must take the following graduate level courses:

Course	Course Title	Credits	Semesters
C&I 453	Special Education Law, Policy & Practices	3	Fall and Even Summers
C&I 524	Family and Diversity Issues for Exceptional Learners	3	Fall and Even Summers*
C&I 526	Transition and Community Supports	3	Fall and Even Summers*
C&I 452	Measurement and Observation	3	Fall and Even Summers*
C&I 556	Advanced Methods in Low Incidence Disabilities	3	Spring and Odd Summers*
C&I 523	Advanced Methods in Early Childhood Special Education	3	Spring and Odd Summers*
C&I 458	Effective Academic Intervention	3	Fall and Even Summers*
C&I 560	School-wide Assessment and Instruction: Response to Intervention	3	Spring and Odd Summers*
C&I 463	Advanced Positive Behavioral Supports	3	Spring and Odd Summers
C&I 520	Educational Research	3	All Semesters
C&I 522	Applied Research Methods	3	Fall and Even Summers*
C&I 469	Student Teaching in Special Education	3	All but Summer
	Total	36	

Methods of delivery by telecommunications

To date, the special education faculty has been flexible in meeting the needs of Montana residents who are located in rural areas. Most courses utilize Blackboard and VisionNet. Faculty will continue to teach in a hybrid

format to accommodate the needs of students. It is our plan to offer all of our courses in a blended format, enabling students from distant locations to access this program.

Adequacy

Currently, the Department of Curriculum and Instruction in the School of Education has two tenured and two tenure-track faculty members with expertise in special education: Dr. Richard van den Pol (tenured Full Professor), Dr. Ann Garfinkle (tenured Associate Professor), Dr. Trent Atkins (tenure-track, Associate Professor), and Dr. Morgen Alwell (tenure-track, Assistant Professor). Dr. Alwell was hired in the spring to assist in launching and sustaining these efforts. Minor realignment of faculty full-time equivalency, the addition of a tenure-track faculty line, and the combination and removal of some courses from the current endorsement program will allow for the proposed program to be delivered.

The facilities, equipment, and library holdings for the Special Education Endorsement were found to be satisfactory for accreditation approval by the state and NCATE. Therefore, continuation of the routine updating of facilities and equipment will allow for the Master's in Special Education to be implemented and sustained. The analysis of the library holdings relative to this degree is included in this document (see attachment B).

Accreditation

Because all of the programs in and associated with the School of Education are accredited by National Council for the Accreditation of Teacher Education (NCATE) on a seven-year rotation, there will be no additional expenses or changes in the timetable or in costs to The University of Montana or the School of Education for accreditation. As will be discussed below, the outcome assessment for the program is aligned with the NCATE standards and the standards set forth by the Office of the Commissioner of Higher Education and The University of Montana.

Assessment

Intermediate and end-of-instruction assessment of student performance by quantitative and qualitative measures

The Assessment of student performance will be conducted by using the competencies that are recommended by the Council for Exceptional Children, the Montana Office of Public Instruction, and used by NCATE. Existing and proposed courses are aligned to those competencies. The achievement of those competencies will be determined with the compilation of a variety of products. The capstone product or experience will be a thesis or a professional product (this option would be completed in C&I 522), depending on students' preference and training before entrance into the program. Other products that will document the achievement of competencies will include: papers from classes, video footage of classroom teaching, local, state, or regional presentations, records of K-12 student achievement and performance, evidence of classroom adaptations, evidence of consulting with other school professionals on preventative measures, artifacts and evidence of change regarding improved instructional protocols, and parent communication that demonstrates cultural and linguistic awareness, understanding and sensitivity.

These products will be arranged in a portfolio. This portfolio can be submitted in either hard copy or in electronic format, and subsequently presented to a faculty panel and a group of peers for evaluative purposes. For student teachers, the rubrics and assessment procedures from the field placement office will also be used.

Entry level preparedness and predicted success of students—collection of baseline data

An application process that consists of 10 criteria for admission is currently used by Curriculum and Instruction M.Ed. Program. These 10 criteria include: letter of intent; narrative statement of teaching philosophy; resume; Bachelor's degree location, content area, and GPA; three letters of recommendation; verbal GRE; quantitative GRE; and writing GRE. These same criteria are applicable to this proposed program for the sake of congruence and consistency, this same process and these same criteria will be used.

Student/alumni satisfaction

A part of the portfolio review discussed above, students will be asked for comments on their experiences in the program and asked to provide suggestions for improvement. A student/alumni survey will be developed and

sent to a sample of students each spring. This process will be coordinated with other graduate programs and the Field Placement Office in the School of Education.

Employer satisfaction

Two methodologies will be used to obtain employer satisfaction data. First, a survey will be developed and distributed to administrators in districts where graduating students obtain teaching positions. Second, every two years local administrators will be invited to take part in a focus group. The purpose of this focus group will be to obtain open-ended information about the performance of former students and the overall satisfaction of employers.

Program review

Course evaluations and advisor evaluations will be collected each semester; feedback will be used to improve course and program quality. Also, the information that is obtained from the student/alumni and employer satisfaction data collection processes will be used as formative evaluation. This information will be reviewed on a bi-annual basis. Also, the NCATE accreditation process will be used for a summative evaluation of the program (every seven years). Additionally, special education faculty members are involved in a state-sponsored High Education Consortium (HEC) in collaboration with all universities in Montana. Part of the function of HEC is to review what is being taught in each of the programs. The process has served and will continue to serve as a way to receive external feedback on the program.

Additional faculty requirements, including qualifications, salary, and recruitment. Details may include:

Due to the foresight of faculty in the Curriculum & Instruction Department in recognizing the need for updating and expanding the special education endorsement program, additional faculty are not needed at this time; following the recent retirement of a tenured faculty member the faculty line was reshaped, and a successful national search led to hiring Dr. Alwell. The proposed program would require two graduate assistantships and a staff person to support technological innovations. We feel that these support personnel are essential, given the 3-3 teaching load in C&I and our desire and ambition to take a leadership role in technological innovations, offering courses that are accessible to individuals not only regionally, but also potentially around the globe in all semesters, including summers.

We anticipate GAs would do the following: teach courses, assist with course development and course management, research efforts, supplementary advising, assist with program dissemination and recruitment, and other duties as assigned.

The proposed cost is \$9,000 per year per assistant plus approximately \$4,000 for tuition credit. Therefore, the total cost for two Graduate Assistants would be \$26,000 annually.

The School of Education is taking a leadership role in distance education and technological support for this Master's program would be beneficial for programs across the school. While a version of this program could be implemented without this person, the addition of this person would greatly serve faculty and students. Specifically, students would benefit from direct technological assistance and faculty time could be spent on using cutting-edge practices to implement the most current content in a technologically-advanced format.

We anticipate the Technology Assistant would do the following: (a) assist with the development of the technological aspects of courses, assist with set up of class sessions, continuously upgrade hardware and software, identify and implement technological application that assist both the instructor and enrolled students, assist with training faculty and staff in technological applications and provide technical assistance to enrolled students.

The proposed cost would be \$17,979.66 (.50 FTE) including all benefits.

Impact on facilities

The launch of this new program would perfectly coincide with the completion of the Phyllis J. Washington Education Center. With a focus on technology, this program will provide leadership in the development of technologically advanced training. This program will not require additional space beyond the capacity of the new addition.

Impact on Enrollment, numbers of students with lower and upper-division course breakdown and the number expected to graduate over a ten-year period.

With the arrival of Drs. Atkins and Garfinkle, the Special Education program has grown significantly. Specifically, before Drs. Atkins and Garfinkle were on faculty the mean number of special education student teachers was 10.7 per semester. Since Drs. Atkins and Garfinkle arrived, the number of special education student teachers has increased to a mean of 16.1 students per semester. With the addition of this new program and Dr. Alwell, we would anticipate an additional increase in students. This increase is likely to come in the form of new graduate students. Thus the program intends to attract 10% of undergraduate teacher education students (approximately 16 student full time equivalents), which is on par with current figures. The proposed program will also allow us to attract 20 graduate students per year. This figure is based on the average number of new students admitted to the program when a grant funded Masters program in Early Childhood Special Education was initiated. All courses for the endorsement and the Masters' program are at the undergraduate and graduate level (i.e., 400-level) or the graduate level (i.e., 500-level) and all would take all required courses. Over a ten year period we would hope to graduate 360 students. This would help dramatically decrease the number of special education positions not currently filled in the State of Montana.

Planned student/faculty ratios

At the undergraduate level, we plan to have a 1:4 student/faculty ratio and at the graduate level we plan to have a 1:5 student /faculty ratio. While the 1:4 student/faculty is well below the School of Education's 1:10 undergraduate to faculty ratio this is a figure that only accounts for students getting special education licensure and not the total number of undergraduate students taught by the special education faculty. For example, the special education faculty teach a course required for all teacher licensure candidates (i.e., C&I 410: Exceptionality and Classroom Management) where each section has 25-30 per semester and C&I 520 with a typical enrollment of 15. In addition, the 1:5 ratio for graduate students is higher than the School of Education's 1:3 graduate student/ faculty ratio. This increase is off-set by the lower undergraduate figure and is in-line with the University's priority for increases in graduate students.

Any special admission standards or enrollment limits

Admissions to the program will be commensurate with the standards already set in the Department of Curriculum and Instruction. And, enrollment will only be limited when it is determined that students cannot move through the program easily due to the number of students enrolled (i.e., closed classes, faculty advising load too high, or practicum placements insufficient for program needs). At this time we do not know what the cap is, because we have not yet gotten close to capacity.

Relationship to other programs on campus

The expanded course sequence in the proposed program allows for greater collaboration between C&I and colleagues in Communicative Sciences and Disorders, the Rural Institute, School Psychology and Physical Therapy. See the letters of support from each of these programs in the appendix.

Relationship to other institutions

Montana State University at Billings has a Master's degree in Special Education; however, this proposal has clearly established that there is a great in this state to provide other options for teaching professionals to obtain an endorsement and a graduate degree in Special Education. Currently, individuals seeking an advanced degree in Special Education have limited options and they often choose the Curricular Studies M.Ed. While this is satisfactory for some students, it does not provide the advanced training they need to work with students with identified disabilities and those who are at-risk for having a disability. It is our belief that students on the western side of Montana do not travel to Billings to obtain a Master's degree—and since many are working professionals, it simply is not an option. Therefore, while it is not typical to offer the same degree program at multiple universities in the state, in this instance, it is logical and pressing for The University of Montana to have a Master's Degree in Special Education.

Process Leading to Submission of Proposal

This proposal has been reviewed and approved by the Department of Curriculum and Instruction, other related departments at The University of Montana (see letters of support), the Dean of the School of Education, the Provost and Vice President for Academic Affairs, and the Faculty Senate of The University of Montana. No outside consultants were employed. Data from the Department of Education and the Office of Public Instruction were used.

Verification of review of the proposal by the affected departments and under units, such as:

This proposal was reviewed and approved by the affected departments as follows:

Department: **Curriculum and Instruction** Date: September 5th, 2008

In addition the deans of the following Schools/Colleges reviewed and approved the proposal:

Dean of SOE: **Dean Roberta Evans** Date: September 26, 2007

The proposal was reviewed and approved by the Faculty Senate Date: December 4, 2008

[No outside consultants were employed for the development of this proposal.]

January 7-8, 2009

ITEM 142-1003-R0109

Permanent approval for the Energy Technology A.A.S. degree**THAT:**

In accordance with Montana University System Policy, the Board of Regents of Higher Education authorizes The University of Montana – Missoula to approve for permanent status the experimentally offered Energy Technology A.A.S. degree.

EXPLANATION:

The University of Montana-Missoula COT currently offers an Associate of Applied Science in Energy Technology on an experimental basis. Rapid growth and expansion in the energy sector, and particularly in renewable energy, has created an unmet demand for skilled technicians and professionals across the nation and the globe. The Energy Technology program is one of the few established programs in the country, and one of the only programs in the state of Montana, that offers any kind of degree—2-year, 4-year or graduate—in energy. The success of the experimental offering indicates there is both an interest and a need for this kind of training. Permanent approval of this program will allow the University of Montana College of Technology as well as the state of Montana to retain the lead it now enjoys in providing a unique educational opportunity that is responsive to growing concerns over energy independence, national security, and environmental quality.

ATTACHMENTS:

Appendices [A](#), [B](#), [C](#)

MONTANA BOARD OF REGENTS

LEVEL II REQUEST FORM

Item No.:	142-1003-R0109	Date of Meeting:	January 7-8, 2009
Institution:	The University of Montana-Missoula COT		
Program Title:	Energy Technology A.A.S. program in Applied Computing and Electronics Dept.		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

The University of Montana-Missoula COT requests permanent approval of the experimentally offered Energy Technology Associate of Applied Science degree program.

**Proposal for an
Energy Technology A.A.S. Degree Program**

1. Overview

The University of Montana College of Technology Department of Applied Computing and Electronics requests permanent approval for its Associate of Applied Science (A.A.S.) degree in Energy Technology. The program introduces students to the full suite of energy systems and technologies—traditional and renewable—and prepares them for careers in the rapidly expanding energy industry. Graduates of the program are general practitioners skilled in energy system design, installation, maintenance, troubleshooting, and operation; site identification and assessment; structural audits for energy efficiency and conservation; project management; regulatory compliance; and, preparation of basic economic, environmental, and social assessments.

2. Need

Access to clean and abundant supplies of energy is a driving force at the local, state, national, and global level. Growing public concerns over national security, climate change, environmental quality, and energy independence are fueling the growth and diversification of the energy sector in Montana and across the globe. The energy sector is employing new technologies to harness solar, wind, geothermal, biomass, wave and tidal energy even as new and cutting edge technologies promise to reduce environmental impacts of traditional fossil fuels. Public awareness of and desire for energy efficiency and conservation is driving demand for innovative building materials, processes, and designs, and for energy efficient appliances and services.

In the renewable energy (RE) and energy efficiency (EE) sectors, industry demand for skilled technicians exceeds many times over what schools are able to deliver. In the commercial wind sector the gap between the availability of and demand for skilled RE technicians has driven wind companies to develop in-house training programs (pers. com, Columbia Gorge CC Summer Wind Institute, June 24, 2008) and still they cannot fill the openings. Projections on growth in RE jobs vary wildly, in part because the growth rate depends upon government policies. A Worldwatch Institute report published in July 2008 puts current RE employment worldwide at about 2.3 million, and offers the caveat that this number is most likely “conservative.” This reflects employment in both direct and indirect industries. The report goes on to state that in those countries with government policies that aggressively support RE development, employment in the renewable energy sector is expected to almost double by 2020 (Renner, 2008).

While the rate of growth in employment in the RE sector in the US has historically been directly related to federal policies, favorable policies at the state and local levels can impact regional employment in the energy sector. Governor Schweitzer has made energy development—traditional and renewable—in Montana a priority in his economic development plan, particularly in rural areas with a wide variety of renewable energy sources from which to draw.

A variety of concerns and factors are fueling the growth and evolution of the energy sector. But whatever the impetus, a need exists for skilled energy professionals who can offer a broad range of skills and services to individual consumers, small businesses, and large corporations.

Students and other constituencies wishing to acquire skills and knowledge in energy systems and technologies will be well-served by this program. The program and individual courses have a wide appeal. Historically, energy courses have been filled by students from such diverse departments as environmental studies, geosciences, geography, journalism, fine arts, business administration, communications, resource conservation, chemistry, anthropology, carpentry, and English. The promise of working in energy, or at least being able to make informed decisions about energy systems, has attracted professionals, many of whom are post-baccalaureates currently working in plant management, law offices, energy auditing firms, corporate communications, the airline industry, to name a few. Energy courses are also of interest to those in construction, plumbing, HVAC (heating, ventilation, and air conditioning), and well-drilling. In most instances these professionals are seeking to enhance their knowledge of renewable energy systems and technologies to meet the demand from clients interested in installing small-scale, renewable energy systems in homes or commercial buildings.

In addition, individual energy technology courses form part of the 'solutions' module in the proposed Climate Change Studies minor. Environmental studies students find that specialty energy courses satisfy their need for skill-based knowledge of different energy technologies and applications that can be deployed to address sustainability issues.

Finally, the energy industry—from the small business entrepreneur to the multi-national corporations—is seeking skilled workers to meet the increasing demand for the design, installation, operation, maintenance, and management of renewable energy systems at all scales.

The University of Montana College of Technology's energy program is broad-based as fits the scale of traditional and renewable energy enterprises in Montana, and as fits the mission of The University of Montana. Small to midsize energy-based businesses require technicians with knowledge of a variety of systems—solar, wind, geothermal, biomass or oilseeds, small hydroelectric—as well as energy efficiency and conservation measures. Large corporations with more specialized installations in one type of energy are also keen to hire graduates with a broad knowledge of energy technologies (pers. com., Michelle Montague, Suzlon Wind Energy Corp. and American Wind Energy Association Education Working Group, 6-24-08).

Demand for the program is strong, and interest is expected to continue to grow. The program is now in its third semester. Enrollment for fall 2007 was 22, for spring 2008, 12, and for fall 2008 we accepted 44 into the program. All specialty energy technology courses tend to run at or near capacity.

3. Institutional and System Fit

The Energy Technology program shares common interests with several other campus programs and initiatives. Our courses appear in the Solutions module of the proposed Climate Change Studies minor; we are working with EVST on the UMFLAT project; our instructors participated in the Focus the Nation day; we have worked with the Sustainability Internship Team on a student internship involving solar energy; we share courses with the Industrial Technology department and look forward to working with them on projects and grants in the future involving green building. As the program becomes established, we look forward to expanding our connections with more departments across campus. Approval of the proposed program will not require changes to any existing programs.

In 2002, UM President George Dennison signed the Talloires Declaration “rededicating UM to promoting sustainable development, self determination and social justice on local, state, national and global levels.” To achieve these commitments, President Dennison appointed the Sustainability Campus Committee charged with “identifying and recommending specific actions and strategic plans the University community can pursue in moving the University towards greater environmental sustainability in its operations, research, teaching and service/outreach functions.” Included in this mission and that of all universities, is education and information exchange.

In 2007, the UM president signed the American College & University Presidents Climate Commitment “dedicating UM to reduce its carbon emissions to zero -- a key part of making UM a model for sustainability.” The SCC recently released the campus greenhouse gas emissions report, completing the first step in fulfilling President Dennison's commitment to sustainability. In addition, at the Governor's request, all state buildings are undergoing energy audits with the mandate to improve energy efficiency by 20% by 2010.

The existence of an academic program dedicated to educating students in all types of energy systems and technologies, as well as energy efficiency and conservation measures, clearly fits with the University's strategic mission and the President's commitments. In keeping with the mission of an academic institution, the program seeks to educate students about energy systems and technologies so that they and the people with whom they work can make informed decisions about energy choices.

At present there are no similar programs within the Montana University System, though, it is our understanding that other schools are considering developing programs in such areas as bioenergy and wind. Thus, for the present, there is no duplication between the UMCOT program and any other MUS program.

That being said, it is our hope that other schools will develop specialized energy programs that take advantage of their unique physical and cultural geographies and institutional resources. Since it is our contention that one

school cannot do it all, and that each institution will have something different to offer the student interested in energy, we envision working with these new programs to place students who have specific interests that cannot be satisfied by our program. In addition, we hope to take advantage of any expertise that arises as a result of the establishment of these programs, and would welcome the opportunity to share our own expertise and the lessons we have learned with others who are interested in developing an energy program.

Some of the groundwork necessary for this kind of collaboration has already been laid. UM COT's Energy Technology program, under the auspices of a WIRED grant, has worked to develop partnerships with Miles Community College, Montana Tech of The University of Montana, Stone Child College, and Blackfeet Community College. It is our hope that the initial collaborative work done under WIRED might serve as a foundation for continued collaboration and exchange of expertise across campuses. Specifically, our WIRED partnerships have enabled us to identify faculty expertise, unique institutional assets and resources, as well as geographical, economic, and cultural assets that each institution can call upon when crafting their program. We have established initial articulation agreements

4. Program Details

Program Description

The University of Montana College of Technology's Energy Technology program introduces students to the full suite of energy systems and technologies—traditional and renewable—and prepares them for careers in the rapidly expanding energy industry. Graduates of the program are general practitioners skilled in energy system design, installation, maintenance, troubleshooting, and operation; site identification and assessment; structural audits for energy efficiency and conservation; project management; regulatory compliance; and, preparation of basic economic, environmental, and social assessments.

Program Objectives

The learner objectives for the program are:

- Identify and practice safe workplace habits
- Develop and practice professional standards of communication and conduct
- Comprehend the physical and technical aspects of traditional and renewable energy systems
- Understand the principles of energy production, conversion, transmission, and consumption
- Design, install, troubleshoot, and manage energy systems
- Perform site assessments for renewable energy production
- Prepare basic economic feasibility reports
- Identify factors affecting energy efficiency and conservation
- Assess social, economic, environmental, and political dimensions of energy systems.

These objectives are achieved by offering a series of specialty energy courses built upon a foundation in the mathematics, sciences, communications, computing and business. Ultimately, the rapid evolution of the energy industry and energy technologies requires that graduates of the program possess critical and analytical thinking skills, adaptive problem-solving skills, and research skills for continued, on-the-job learning.

Proposed Curriculum Sequence

		FIRST SEMESTER	AUT	SPR	SUM
BUS	160S	Issues in Sustainability	3		
WTS	101	English Composition	3		
SCN	175N	Integrated Physical Science	3		
CRT	172	Introduction to Computer Modeling	3		
NRG	101	Introduction to Energy Systems I	3		
		TOTAL	15		

SECOND SEMESTER					
EET	111T	Basic Electronics		4	
EET	112T	Basic Electronics Lab I		3	
NRG	102	Introduction to Energy Systems II		3	
CAR	235T	Building Energy Conservation		3	
MAT	118	College Algebra		3	
		TOTAL		16	
SUMMER PRACTICUM					
NRG	191	Energy Practicum (60 hours)			2
		TOTAL			2
THIRD SEMESTER					
NRG	213	Power Systems Technology	3		
MAT	119	Functions and Trigonometry	3		
CRT	209T	Project Management	3		
EVST	101N	Environmental Science	3		
		Select from List* (6 credit minimum)	6		
		TOTAL	18		
FOURTH SEMESTER					
BUS	103S	Principles of Business		3	
NRG	295	Special Topics: Energy Storage and Distribution Systems		3	
NRG	290	Energy Internship		2	
		Select from List* (9 credit minimum)		9	
		Total		17	
		TOTAL			68

*Semesters 3 and 4:

Students must select a total of 5 courses from the following

NRG 295	Special Topics: Fuel Cells 2cr
GEOS195	Special Topics: Fossil Fuels 3cr
NRG 241	Alternative Fuels 3cr
NRG 295	Special Topics: Bioenergy 3cr
NRG 242	Solar and Wind Energy Systems 3
	Directed Elective** 3

**Directed Elective options:

BUS 135T	Business Law 3cr
BUS250T	Entrepreneurship 3 cr.
PSY 110S	Organizational Psychology 3 cr.
COM 150S	Interpersonal Communications 3 cr.
COM 160A	Oral Communications 3 cr.
NRG 295	Special Topics: Energy Choices and Sustainability 3 cr.
CAR236T	Building for Solar Energy 3 cr.
CAR240T	Alternative Construction Materials 3 cr.
SCN120T	Technical Physics I 4 cr.*

SCN121T	Technical Physics II 4 cr.*
	*must take both; can be considered in lieu of SCN175N
EET234T	Automatic Controls 4 cr.
EET241T	Instrumentation 3 cr.
CRT111	Fluency in Information Technology 3 cr.
CRT182T	Computer Aided Design and Drafting 2 cr.

Please see Appendix A for course descriptions.

The program has been implemented. Twenty two students enrolled in fall 2007, 12 in spring 2008, and 44 entered in fall 2008. Enrollment is expected to continue to grow.

5. Resources

Additional faculty resources will be required to implement this program because a 1 FTE faculty line, including directorship of the program, will need to be developed and supported by The University of Montana College of Technology. However, the implementation costs have been covered by WIRED, which will continue to support program activities until June 30, 2009, at which time specialty energy courses will be fully developed and much of the activities (and costs) associated with establishing a program should be complete. After June 30, 2009, the Department of Applied Computing and Electronics and The University of Montana College of Technology have committed to continue to support the program in its day to day operations.

The energy technology-specific courses have been developed and taught by a skilled and knowledgeable pool of adjunct faculty, all of whom work in some capacity in the energy industry. Ideally, as universities and colleges across the country begin to develop baccalaureate and graduate programs in energy and to matriculate graduates, we will be able to hire faculty with expertise in the energy sector and appropriate academic degrees. However, the program must strike a careful balance between faculty with academic credentials and instructors with field experience. According to Al Zeitz, former engineer with GE Wind and now director of Iowa Lakes Community College wind technician program, the single-most important criterion for establishing a successful and credible energy technology program is the employment of instructors with real-world practical experience in the energy sector.

The program has had the benefit of WIRED funding that has enabled us to establish partnerships with campuses across the state, to offer training to faculty, and to fully develop the energy specific courses. These are crucial, fundamental elements upon which to perpetuate the program. Obviously, financial resources will be required to sustain the program, primarily in the form of salaries for faculty, but start up costs have been borne by WIRED.

Those courses offered online impose minimal impact on physical facilities; salaries for online course instructors are covered by UMOonline and Continuing Education. The design of the College of Technology's new campus takes into account the likelihood of increased enrollment in on-site energy courses.

Resources already in place include a learning site at MonTEC, and a 10 kilowatt Bergie wind turbine and 2 kilowatt photovoltaic hybrid system. Both systems are operational, providing student training and public demonstrations. A 1 kilowatt wind turbine, 50 kilowatt wind turbine, fuel cell, and state-of-the-art biomass gasifier/power generator have been procured. The Alternative Energy Research Group at MonTEC has recently purchased hydrogen storage tanks, a fueling station, and a hydrogen vehicle, all of which it has made available to the Energy Technology program. Further learning sites will be created as each of these technologies is deployed. Wind industry, including Suzlon Wind Energy Corp., GE, Vestas, and Siemens have all acknowledged the need for greater industry participation in supplying equipment and training and are developing mechanisms and pathways for getting decommissioned equipment to schools who have energy training programs (pers. com., Columbia Gorge CC Summer Wind Institute, 6-24-08). Current library holdings in the MUS are sufficient and growing.

6. Assessment.

Initial program success is measured first by enrollment, and then by retention and matriculation. The ultimate measure of success, however, is the number of graduates who find work in the energy sector or who go on to pursue higher education in energy related fields.

Periodic review, faculty assessment, student perception, course surveys, employer surveys, and student exit interviews are all used in providing assessment data. In addition, the program's advisory committee continues to provide feedback on the program and its curriculum, and to assess their correspondence to industry needs.

7. Process Leading to Submission

The Energy Technology program has been more than 5 years in the making and has run successfully now for one year on an experimental basis. Contributions to its development came from dozens of industry leaders, interested community members, faculty from across the university, students, and our partner institutions. The program continues to benefit from the expertise and contributions of these individuals, through both formal and informal channels of communication. The advisory committee, composed of members from industry, government, and faculty (see Appendix B) provides guidance on the state of the energy industry and how the program might best meet the evolving demands. The curriculum committee, also composed of members from government, industry, and academia (see Appendix B) continues to work to refine the curriculum scope and sequence as baseline requirements and core skills for energy technicians become clear.

Members from the MT Dept. of Environmental Quality, Sunelco, MonTec, Miles Community College, CTA Architects, Invenergy, Redfield Construction, National Center for Appropriate Technology, OSHA, NorthWestern Energy, PPL Montana, Sustainable Building Systems LLC, USDA Forest Service Missoula Technology & Development Center, Western Agriculture Research Center, and Independent Power Systems, among others, have provided program students with field experiences, job shadowing opportunities, internships, and instruction.

Common interests with the Environmental Studies department, the proposed Climate Change Studies minor, the Sustainable Campus Committee, Green Thread Initiative, Sustainability Initiatives Team, BILT (the carpentry program), and other campus-based initiatives and programs provide the foundation for collaborative projects that create innovative learning opportunities for students in all of these programs. The UMFLAT project proposed and administered by Environmental Studies is one such project, as was the "Think Tank" coffee-shop solar system design project administered by UM Facility Services with the Sustainability Initiatives Team.

The expertise provided by faculty from the departments of Applied Computing and Electronics, Applied Arts and Sciences, Business Technology, Industrial Technology, Geosciences, Environmental Studies, Physics, and Chemistry continues to inform our programmatic mission.

Energy Tech students continue to be an invaluable source of feedback on individual courses and programmatic objectives.

The program meets the minimum standards for regional accreditation through the Northwest Association of Schools and Colleges and all requirements for the Associate of Applied Science Degree from The University of Montana College of Technology. As energy technology-specific accrediting bodies are established, and criteria and standards for programs, faculty, and courses are identified and agreed upon by industry and academia, the program will seek applicable accreditation. The University of Montana College of Technology Energy Technology program is at the leading edge of 2-year programs that are established and matriculating students. As such, we have a unique opportunity to inform the national discussions on standards and metrics for energy technology programs across the nation. Accrediting bodies with whom the program director is working include Interstate Renewable Energy Council (IREC), the Institute for Sustainable Power Inc, (ISPQ), the North American Board of Certified Energy Practitioners (NABCEP), the American Wind Energy Association (AWEA), Solar Energy International (SEI), and OSHA.

Sources:

Anderson, Mark. "Turning Out Wind Power Graduates." Wind Power Monthly, September 2008.

Renner, Michael. "Jobs in Renewable Energy Expanding" Worldwatch Institute, July 8, 2008. Accessed online at: <http://www.worldwatch.org/node/5821> on 9/18/2008..

This proposal was reviewed and approved by the affected departments as follows:

Department Name: <u>Environmental Studies</u>	Date: <u>Sept. 19, 2008</u>
Department Name: <u>Business Technology</u>	Date: <u>Sept. 19, 2008</u>
Department Name: <u>Applied Arts and Sciences</u>	Date: <u>Sept. 19, 2008</u>
Minor: <u>Climate Change Studies</u>	Date: <u>Sept. 19, 2008</u>
Department Name: <u>Industrial Technology</u>	Date: <u>Sept. 19, 2008</u>

In addition the deans of the following Schools/Colleges reviewed and approved the proposal:

Associate Deans of <u>The College of Technology</u>	Date: <u>Sept. 19, 2008</u>
Dean of: <u>The College of Technology</u>	Date: <u>Sept . 19, 2008</u>

The proposal was reviewed and approved by the Faculty Senate at the University of Montana Date: _____ November 13, 2008

[No outside consultants were employed for the development of this proposal.]

Appendix A

COURSE DESCRIPTIONS:

BUS 103S Principles of Business 3 cr. Introduction to the world of business. Examines capitalism, the economic environment, the types of business organizations, management, marketing, production, labor, financing, and business/government relations. Credit not allowed for both BUS 103S and BADM 100S.

BUS 135T Business Law 3 cr. Offered spring. An overview of law as it applies to business transactions. Topics include the nature and source of law; courts and procedure; contracts, sales, and employment; commercial paper; bailments; property; business organizations; insurance; wills and estate planning; consumer and credit protection; torts; criminal law; and agency law. Credit not allowed for both BUS 135T and BADM 257.

BUS 160S Issues in Sustainability 3 cr. This literature-intensive course is intended to expose the student to a variety of essays addressing the balance of economic development with the principles of sustainability and social equity. The student is offered an introduction to sustainability concepts, natural systems/cycles and environmental economics. Natural capitalism and triple bottom line maximization is explored, along with the role of corporations and small businesses in sustainable development. A survey of issues surrounding corporate social responsibility and sustainability-driven innovation will be conducted.

BUS 250T Entrepreneurship 3 cr. Offered spring. Prereq., CRT 100. An overview of the skill areas and business principles needed to start and operate a small business. Includes developing a business plan, identifying sources of capital formation, managing growth, and marketing issues related to new ventures.

CAR 235T Building Energy Conservation 3 cr. Study of the analysis techniques used for reduction of energy consumption and energy management, including energy accounting and energy auditing. Residential and commercial building energy efficiency opportunities will be covered. Other topics addressed include motors, pumps, green building, and purchasing energy supplies. Career opportunities in energy efficiency will be discussed.

CAR 236T Building for Solar Energy 3 cr. Study of the basics of solar energy and design with emphasis on passive solar applications. The elements and design patterns for successful passive solar buildings are covered in detail. Design requirements for solar generated electricity and solar heated water are considered. Also covered are designing new and remodeled buildings to be solar ready, solar retro-fits, and other applications.

CAR 240T Alternative Construction Materials 3 cr. Review of alternative construction materials and other alternative building materials, as well as building materials using recycled components. Re-use of salvaged materials and use of non-traditional building methods such as straw bale and rammed earth construction will be covered.

COM 150S Interpersonal Communication 3 cr. Offered every term. Focus on communicating and listening more clearly to improve personal and professional relationships. Topics include forms of communication, communication and identity, emotion, conflict, climates, gender, and cultural diversity. Credit not allowed for both COM 150S and COMM 110S.

COM160A Oral Communications 3 cr. Offered every term. Introduction to oral communication skills, including public speaking, and small group communications. Focus is on the organization, delivery, and retention of oral messages, listening skill development, and nonverbal communication. Credit not allowed for both COM 160A and COMM 111A.

CRT111 Fluency in Information Technology 3 cr. Offered autumn and spring. Prereq., CRT 100 or demonstrated computing experience. Introduces the skills and concepts of information technology, both from practical and a more theoretical point of view. During lectures and interactive computer labs, students will explore a wide range of digital and information technologies, including common PC applications, networking, databases, privacy, and security. Credit not allowed for both CRT 111 and CS 111.

CRT182T Computer Aided Design and Drafting 2 cr. Offered autumn. Prereq., CRT 100 or demonstrated computer experience. An introduction to computer aided design and drafting software for production of drawings and plans for architecture and engineering systems. Fundamentals of two dimensional drafting and drawing management for professional design

CRT 172 Introduction to Computer Modeling 3 cr. Offered autumn and spring. Prerequisite MAT 100 or demonstrated computing experience. Problem solving and data modeling using computer productivity software. Emphasis using spreadsheets and databases for data analysis. Formal presentation of results. Credit not allowed for both CRT 172 and CS 172.

CRT 209T Project Management 3 cr. Offered intermittently. Prerequisite CRT 172. Investigation of topics in project management including scope, definition, risk, procurement and the RFP. Management of time, cost, quality, and human resources. Concepts are reinforced with PM software.

EET 111T Basic Electronics 4 cr. Introduction to the concepts of electricity, current flow, direct current (DC) and alternating current (AC) electrical circuits. The course covers passive components; scientific notation and metric conversions; voltage, current, and resistance units of electrical measurement; Ohm's Law; analysis of series, parallel, and series-parallel circuits; the use of electrical circuit theorems; electromagnetism; capacitance; inductance; transformers; and motors.

EET112T Electronics Lab I 3 cr. Coreq., EET 111T. The use of basic electronic test instruments and troubleshooting. Building circuits using resistive, capacitive and inductive components.

EET234T Automatic Controls 4 cr. Offered autumn. Prereq., EET 227T. Explores the theory, terminology and components used in automatic control of industrial machines and processes. Uses the servomechanism as a representative control system to analyze open-loop, closed-loop, proportional, integral, and differential control strategies. The use of transducers and computers in automatic control systems in the industrial control setting is emphasized.

EET241T Instrumentation 3 cr. Offered spring. Prereq., EET 227T. The study and analysis of industrial measuring and process control instrumentation in both analog and digital form. Proper selection, use and interpretation of measurement equipment and data

EVST 101N Environmental Science 3 cr. Offered autumn. An introduction to the scientific principles that underpin environmental science and discussion of how these shape national and local environmental laws and policies. Features local approaches to solving environmental problems.

GEOS 195 Special Topics: Introduction to Fossil Fuels 3 cr. A broad introduction to the basic principles and concepts related to the composition of, the exploration for, and the utilization of fossil fuels (coal, coal bed methane, natural gas, and oil). In addition, environmental issues related to fossil fuel development and utilization will be addressed.

MAT 118 College Algebra 3 cr Offered autumn and spring. Prereq., MATH 100D or appropriate placement score. Intended to strengthen algebra skills. The study of functions and their inverses: polynomial, rational, exponential, and logarithmic functions. Credit not allowed for both MAT 118 and any of MAT 120, MATH 121, or MATH 111.

MAT 119 Functions and Trigonometry 3 cr. Offered autumn and spring. Prereq., MATH 111 or appropriate placement score. Preparation for calculus based on college algebra. Review of functions and their inverses, exponential and logarithmic functions. Trigonometric functions and identities, polar coordinates and an optional topic such as conic sections or parametric functions. Credit not allowed for both MATH 119 and any of MAT 120, MATH 121, or MATH 112

NRG 191 Energy Practicum 2cr. Offered intermittently; summers only. Prereq., EET111T or consent of instructor. The practicum provides students with a supervised field experience. Students will gain hands-on experience with energy specific technologies. This opportunity increases students' occupational awareness and professionalism.

NRG 101 Introduction to Energy Systems I 3 cr. A survey of traditional energy systems and technologies. The course introduces the physical and technical aspects of conventional primary energy sources—coal, oil, gas, and nuclear. Consideration is also given to the engineering, economic, social, environmental, and political factors that determine the sustainability of these sources.

NRG 102 Introduction to Energy Systems II 3 cr. A survey of renewable energy systems and technologies. The course addresses the physical and technical aspects of wind, solar, wave, geothermal, hydro, biological, and tidal energy systems. Consideration is also given to engineering, economic, social, environmental, and political factors that determine implementation and sustainability

NRG 213 Power Systems Technology 3 cr. Autumn only. Prereq., EET111T Basic Electricity or consent of instructor. Reviews the principles of electricity, magnetism, and transformer action; the application of these principles in the operation of single-phase and three-phase ac/dc motors, alternators, and generators; and the control methods for these electrical devices.

NRG 290 Energy Internship 2 cr. Prereq., consent of instructor. Students will complete a field experience at an energy-related site or in an energy-related industry. This experience increases student competency in the field, prepares the student for initial employment, and increases occupational awareness and professionalism. A series of career development seminars and activities related to the field experience are completed in parallel.

NRG 241 Alternative Fuels 3 cr. Identifies alternative fuel sources; explores basic chemistry of fuel characteristics; identifies and evaluates the infrastructure required to produce, store, distribute, and use them; discusses emission and conversion efficiencies; assesses social, environmental, and economic impacts.

NRG 295 Special Topics: Bioenergy 3 cr. Solar energy is stored within plants and can be captured and used to fuel mankind's industrial machines. As biomass is ubiquitous and renewable, it has tremendous potential to help supply the world's energy needs. This class broadly exams the issues surrounding biorenewable resources and the technologies currently being utilized to tap into this vast resource.

NRG 295 Special Topics: Fuel Cells 2 cr. An introduction to the different types of fuel cells (hydrogen, biological, metal/air, proton exchange membrane, etc.) accompanied by a critical examination of their applications, operation, efficiencies, advantages and disadvantages.

NRG 242 Solar and Wind Systems 3 cr. An introduction to the fundamentals of solar and wind energy for the design and installation of solar and wind systems. The material includes an overview of the physical systems and technologies, and will prepare students for a career in renewable energy or for installing a renewable energy system on their own home.

NRG 295 Special Topics: Energy Storage and Distribution Systems 3 cr. Examines methods of storage, transportation, and transfer for different types of traditional and renewable energy. Explores emergent technologies and mechanisms designed to enhance efficiency; provides tools for assessing the relative social, economic, and environmental merits of each type of energy system in terms of its storage and distribution. Emphasis on the electrical grid system

NRG 295 Special Topics: Energy Choices and Sustainability 3 cr. Elective. Explores, within a cultural context, the issues of energy supply, sustainability, security, economic development, transition, and environmental protection, as they relate to traditional, alternative, and emerging energy technologies.

PSY 110S Organizational Psychology 3 cr. Offered autumn and spring. Foundation in the psychological processes that influence behavior of people in work settings.

SCN 175N Integrated Physical Sciences 3 cr. Offered every term. An introduction to the basic principles of physics, chemistry, environmental and earth sciences, biology, emphasizing the scientific method and real-world applications.

U SCN120T Technical Physics I 4 cr. Offered autumn. Prereq., Mat100 or MATH 100. Introduction to models, measurements, vectors, motion in a straight line, motion in a plane, Newton's laws of motion, application of Newton's laws, and circular motion and gravitation.

U SCN121T Technical Physics II 4 cr. Offered spring. Prereq., SCN 120T. Introduction to work and energy, impulse and momentum, rotational motion, equilibrium of a rigid body, elasticity, heat, and thermodynamics.

WTS 101 English Composition 3 cr. Prerequisite COM 090T or passing score on placement test. Instruction and practice in both the expository writing and research process. Emphasis on the use of specific techniques of writing to develop style, unity, clarity, and force of ideas, and structure. Students are expected to write without major errors in sentence structure or mechanics. Credit not allowed for both COM 101 and ENEX 101. Grading A-F, or NC.

Appendix B*Advisory Committee*

Tom Bishop	Owner/President	Sunelco
Georgia Brensda	Air, Energy, and Pollution Prevention Bureau	MT Dept. of Environmental Quality
Len Broberg	Director, Professor	Dept. Environmental Studies
John Campbell	Renewable Energy Program Director	UM
T.J.Fite	Engineer, Owner	NorthWestern Energy
Tom Gallagher	Chair, Program Dir.	Remote Power Systems
Howard Haines	Energy Engineer	Computer Technology UM COT
Jim Headlee	Program Director	MT Dept. of Env. Quality
Dale Horton	Architect & Sustainable Energy Program Mgr	COT Diesel Tech Program
Brian Kerns	Project Manager AET Research Group	NCAT
Paul Miller	President and CEO	MonTec
LeeTavener	Owner & Member	Sustainable Systems, LLC
HollyThompson	Lecturer	Solar Plexus
		Dept. of Chemistry, UM

Curriculum Committee

Holly Thompson	Department of Chemistry
David Andrews	Department of Physics
	Department of Applied Computing and Electronics
Tom Gallagher	
Tom Bishop	Sunelco
Paul Miller	Sustainable Systems LLC
Georgia Brensda	MTDEQ
Brian Kerns	AET MonTec
Dale Horton	NCAT
Howard Haines	MTDEQ
Ashley Preston	Energy Technology

Appendix C*Letters of Support*

Over the long course of its development, the Energy Technology program and its curriculum have garnered the input and continued support from private employers, state agencies, industry leaders, accrediting bodies, faculty and department chairs, and other academic units. Below is a list of those who have written letters of support. The letters are available upon request.

- Sustainable Campus Committee
- Department of Chemistry
- Department of Environmental Studies
- Department of Industrial Technology
- Department of Physics
- Climate Change Studies minor (proposed)
- Sustainable Building Systems, LLC
- homeWORD
- MonTec
- Sage Mountain Center
- CTA Architects Engineers
- Montana Dept of Environmental Quality
- Thirsty Lake Solar
- Gross Electric
- Interstate Renewable Energy Council
- WindCatcher and Windraulics
- Montana Community Development Corporation
- Montana Associated Technology Roundtables
- Sundance Solar Systems
- United Hydrogen Sources
- Solar Plexus, LLC
- Montana Renewable Energy Association
- Oasis Montana, Inc
- National Center for Appropriate Energy
- Sunelco, Inc
- Windpark Solutions America
- Community Power Corporation
- Independent Power Systems, Inc
- North American Board of Certified Energy Practitioners

January 7-8, 2009

ITEM 142-301-R0109

Approval to offer an Associate of Applied Science In Graphic Design; Flathead Valley Community College

THAT:

The Board of Regents of Higher Education authorizes Flathead Valley Community College to award an Associate of Applied Science in Graphic Design.

EXPLANATION:

This proposal is an expansion of FVCC's existing Certificate of Applied Science in Graphic Arts. The new program complements the existing certificate by adding courses from other departments, along with creating new courses in 3D Modeling & Animation, to create a two-year program in graphic design. The process of developing this program has been an on-going collaboration for the past two years working with an advisory council to meet the needs of the local job market.

M O N T A N A B O A R D O F R E G E N T S
LEVEL II REQUEST FORM

Item No.:	142-301-R0109	Date of Meeting:	January 7-8, 2009
Institution:	Flathead Valley Community College		
Program Title:	Associate of Applied Science in Graphic Design		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- 2. Implement a new minor or certificate where there is no major or no option in a major;
- 3. Establish new degrees and add majors to existing degrees;
- 4. Expand/extend approved mission; and
- 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

Flathead Valley Community College (FVCC) seeks approval to award the Associate of Applied Science degree in Graphic Design.

MONTANA BOARD OF REGENTS
New Academic Program Proposal Summary

ITEM 142-301-R0109

Institution: Flathead Valley Community College (FVCC)

Program Title: Associate of Applied Science Degree in Graphic Design

1. Overview: Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The proposed Associate of Applied Science degree in Graphic Design expands upon the foundation of the existing Graphic Arts certificate program and provides students with the detailed background necessary for a career in the graphic design field. The one-year certificate program was designed to give students a solid foundation with the industry standard software programs. The proposed AAS degree provides additional course offerings in two-dimensional and three-dimensional design, 3D animation, marketing, algebra, and the art of photography. In addition, at the end of the two-year program, students will complete an internship where they will work with a local business applying the techniques and skills gained during their course of study at Flathead Valley Community College.

2. Need:

a. To what specific need is the institution responding in developing the proposed program?

FVCC is responding to the local demand and need for graphic designers. The current advisory council is supportive of the program expansion and agrees that graduates from a two-year program will be marketable and will have the technical skills necessary to begin a career in an entry-level position or as a freelance artist. The addition of curriculum in 3D animation is in response to a request from the economic development community related to the workforce needs of a media arts business that plans to locate in the Flathead Valley.

The Flathead Valley has the population and growth viable for additional companies that specialize in advertising, branding, and corporate identity. The advisory council is aware of the current graphic design market in Bozeman and Missoula, and council members indicated that, with a two-year degree program in the Valley, a skill base would be created to support a market comparable to the market in those cities.

b. How will students and any other affected constituencies be served by the proposed program?

The program will serve students by providing them a local opportunity to pursue a career in graphic design. Students completing the Graphic Design program will have acquired the technical knowledge and the creative skills necessary for a career as a multimedia designer, graphic designer, illustrator, production artist, Web designer, or

animator. Graduates of the program will be qualified to work in an entry-level position at an advertising agency, publishing company, printing company, or Web design business.

Currently, professionals within the community have expressed an interest in expanding their knowledge and skills in the graphic design field by enrolling in the one-year certificate program. Working professionals account for approximately ten percent of the current enrollment. These professionals stated that FVCC has provided an exciting opportunity to allow them to expand their skills, and they welcome the opportunity to learn more with the addition of the AAS degree.

The graphic design courses have also provided students pursuing associate degrees an opportunity to take elective courses. In fact, some students are fulfilling all possible electives with graphic design courses because they complement their course of study.

c. What is the anticipated demand for the program? How was this determined?

The graphic design courses at Flathead Valley Community College have high enrollment and demand. During the 2007-2008 academic school year, eight students expressed interest in the one-year certificate. Within one year, student enrollment in the certificate program has jumped to 20 students – classroom capacity.

In a recent survey of the current one-year certificate students, eighty percent of the respondents indicated a strong desire to complete an Associate of Applied Science in Graphic Design. In addition, the Arts and Technology career cluster has sparked interest at the local high schools. This new initiative has given exposure to graphic design and has allowed students to explore career possibilities. FVCC will host a career day in January when students from local high schools will attend the “College for a Day” event. The graphic design sessions are proving to be a popular choice with high school students during early registration. As local high schools continue to allow students the opportunity to explore careers through the new career cluster initiative and the “College for a Day” program, the popularity of the art programs at FVCC will continue to grow. In addition, advisory council members were surveyed, and they indicated demand for the program justifies the expanded two-year program.

3. Institutional and System Fit:

a. What is the connection between the proposed program and existing programs at the institution?

The current program is a one-year Graphic Arts Certificate of Applied Science. This program has been available for students since the fall semester of 2007. The proposed program is a two-year Associate of Applied Science degree in Graphic Design. The new two-year degree program will incorporate existing courses from other departments, as well as add new courses, to provide the students with additional curriculum in two-dimensional and three-dimensional design, 3D animation, marketing, algebra, photography, and an internship opportunity. Two new courses have been developed specifically for this program: 3D Animation and Modeling and 3D Animation

and Modeling II. The proposed curriculum for these classes will allow students to become proficient using a 3D imaging software program that is used for special effects in movies and video games.

The proposed Graphic Design program dovetails with the existing Information Technology-Web Technology Associate of Applied Science degree program. The Graphic Design and Web Technology programs share three common courses: Digital Imaging, Web Development Tools: Dreamweaver, and Interactive Media for the Web. The new graphic design courses will provide opportunities for Web Technology students to further their knowledge in the fundamentals of design. In addition, students in the Graphic Design program will have the option to expand their Web design skills, if they develop an interest in the introductory Web design courses.

The Graphic Design Advisory Council is active in providing the instructors with local connections to small businesses. Local businesses are willing to work with FVCC's students, allowing them to create logos, posters, banners, and Web sites in order to help them gain real-world experience. For example, the local Flathead County Library contacted FVCC and proposed that the College's Marketing program work with the Graphic Design students to create a new identity for the library. With a two-year degree program, a project allowing Marketing students to work together with Graphic Design students would benefit students in both programs, as well as the community.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Approval of this proposal will not require changes to existing programs. The existing Certificate of Applied Science in Graphic Arts will be expanded to include those classes necessary for completion of an Associate of Applied Science in Graphic Design.

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

The proposed Graphic Design program shares three computer-based courses with the existing Information Technology-Web Technology Associate of Applied Science degree program. The courses are: Digital Imaging, Web Development Tools: Dreamweaver, and Interactive Media for the Web. The Web Technology program is more technical in nature providing students with networking, database, and programming courses.

d. How does the proposed program serve to advance the strategic goals of the institution?

Flathead Valley Community College promotes excellence in lifelong learning by offering two-year college programs, the first two years of a four-year college degree, occupational training, and opportunities that enhance the cultural, social, and economic well-being of its students and communities. The Graphic Design program advances the following strategic goals of the institution:

- We will increase lifelong learning opportunities for our students and our community.
- We will be responsive to the community's economic and workforce training needs.

The expansion of the one-year certificate program to include an Associate of Applied Science degree clearly reflects the College's strategic goals. The Graphic Design courses will be available to professionals within the community who want to further their training by learning new software programs or by updating their existing skills. The inclusion of two-dimensional and three-dimensional design and 3D Modeling & Animation courses in the new program meets the community's current and future workforce needs. Members of the current advisory council have indicated they will hire students who graduate from the proposed program.

- e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.**

FVCC's Associate of Applied Science in Graphic Design is a technical degree designed to meet local workforce needs. The College of Technology in Great Falls recently created an Associate of Applied Science in Graphic Design to meet the workforce needs in the Great Falls area. FVCC and Great Falls COT staff reviewed program curriculum at both campuses and have determined that, while there are some common courses, the programs are unique in their response to local workforce needs. FVCC's degree expands upon its strong existing Certificate of Applied Science in Graphic Arts adding 3D animation and modeling components in response to the specific needs of new businesses in the Flathead Valley.

Graduates of FVCC's new program in Graphic Design will be able to articulate into Bachelor of Applied Science programs at one of the four-year colleges or universities. This option will allow students to earn general education credits in their junior and senior year, as well as take additional coursework in business, art or computer applications to complement their AAS degree. The MSU-Billings online program will be a good option for many of these place-bound students.

As with the Great Falls program, FVCC's degree is designed to prepare students for entry-level technical positions, distinguishing it from the fine arts emphasis at the four-year campuses. Although the new degree is not designed as a transfer program, individual coursework can be articulated, and initial contacts have been made at MSU-Northern, MSU-Bozeman, and The University of Montana to establish these articulations.

4. Program Details:

- a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications.

Total Number of Credits: 62
Gen. Ed./Related Instruction Credits: 13
Length of Program: 4 semesters/2 academic years

Fall Semester

<u>Course</u>	<u>Title</u>	<u>Credits</u>
ART 101	Drawing I	3
ART 151	Design I	3
ART 144	Design for Graphic Communications	3
CPMA 275	Web Development Tools	3
ART 153	Digital Imaging	3
Total		15

Spring Semester

<u>Course</u>	<u>Title</u>	<u>Credits</u>
WRIT 122	Intro to Business Writing OR	3
WRIT 101	College Writing I	
ART 152	Design II	3
ART 103	Understanding Photography	3
ART 148	Digital Illustration	3
ECNS 201	Economic Principles: Microeconomics OR	3
ECNS 202	Economic Principles: Macroeconomics	
Total		15

Fall Semester

<u>Course</u>	<u>Title</u>	<u>Credits</u>
ART 249	Digital Imaging II	3
ART 248	Digital Illustration II	3
BADM 140	Principles of Marketing	3
ART 267	3D Modeling & Animation	3
M 095	Intermediate Algebra	4
Total		16

Spring Semester

<u>Course</u>	<u>Title</u>	<u>Credits</u>
ART 247	Portfolio Preparation	3
CPMA 274	Interactive Media Web	3
ART 268	3D Modeling & Animation II	4
BUS 276	Internship	3
Elective	Elective*	3
Total		16

Program Total: 62 with 13 in General Education/
Related Instruction

**Approved Electives*

ART 251 Life Drawing I

ART 221 Art Hist: Survey I: Ancient

ART 228 Hist. Early Italian Renaissance

ART 149 Digital Publishing

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

The program will begin in Fall Semester 2009 contingent upon Board of Regents' approval. The anticipated initial program enrollment is twenty students. These projections were determined by analyzing current enrollment trends in the FVCC certificate program. The Graphic Arts certificate program currently has twenty students enrolled. Projected enrollments include current FVCC students and new annual enrollments.

Projected Enrollment FY2009		Projected Enrollment FY2010		Projected Enrollment FY2011	
1 st year students	2 nd year students	1 st year students	2 nd year students	1 st year students	2 nd year students
20	10	20	15	20	18

5. Resources:

a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

The new program will require two additional adjunct faculty members. Currently, two adjunct faculty members teach courses within the one-year certificate program, and one full-time faculty member teaches in Web Technology and Graphic Design. A pool of qualified adjunct faculty exists, and members of the advisory council have shown interest in teaching courses within the program. Local businesses have offered to host internships for students participating in the new program.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

In 2007, FVCC completed a new Arts and Technology building with up-to-date classrooms and equipment. With this expansion, the FVCC art department is thriving. The new building includes two computer labs featuring both PC and Mac computers, along with other classrooms, each dedicated to specific areas in art. Recently, the Mac computer lab was upgraded to include individual Wacom tablets. These tablets give students the opportunity to create drawings, logos, and designs in an electronic format. The current computer labs dedicated to the Graphic Design programs are state-of-the-art containing equipment and software that allow our students to create competitive, high-quality products.

Autodesk Maya 2009 is the most current and powerful version of 3D modeling software in today's market. More than 70 percent of Hollywood films' special effects and most 3D games are now done in Maya. Successfully integrating 3D modeling into the proposed program will require the most up-to-date software available. FVCC

would use computer fees to fund the purchase of Autodesk Maya 2009 for the school's computers. Estimated cost is \$6,300.

6. Assessment:

a. How will the success of this program be measured?

The Graphic Design program has the support of an active advisory council consisting of local graphic design representatives. The council meets at least twice a year to evaluate the success of the program and advise regarding program needs. The success of the program will also be measured by the graduation completion rates, student retention, enrollment numbers, program review, placement surveys, employer satisfaction surveys, and internship evaluations.

7. Process Leading to Submission

a. Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The Associate of Applied Science in Graphic Design has been on the institution's program planning list for several years. In fall 2006, the creation of the one-year certificate program began by creating an advisory council of local professionals and developing the curriculum sequence and courses. One year later, the College began offering the certificate program to students. In response to student and employer requests, the college began development of the associate's degree.

Development of this proposal was in compliance with established FVCC program development processes. The request to expand the Certificate of Applied Science to an Associate of Applied Science degree initiated at the division level in response to student inquiries and advisory council member requests. The AAS in Graphic Design received Faculty Senate, Curriculum Committee, and FVCC Board of Trustee approval before being submitted to the Board of Regents.